

CORNELL EXTENSION BULLETIN 727

Swine Production

JOHN P. WILLMAN



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In Brief

THE hog is intelligent and, in comparison with other animals on the farm, is one of the best "housekeepers." A hog will try to keep his quarters clean if he is given an opportunity to do so. One should not criticize the hog too severely for digging holes in the ground and for wallowing in the mud, because this is the only method he has of cooling himself. Swine are not equipped with so many sweat glands as are other farm animals and for this reason they like to dampen their bodies to keep cool. They should not be allowed to wallow in stagnant mud holes.

On many farms, the swine enterprise would be more profitable if the hogs were provided with more sanitary quarters and were properly fed and handled. It should be the goal of every breeder to produce the type of pig that is demanded by feeders, breeders, and butchers. It is reasonable for a farmer to expect, if he does his part, a gilt to raise at least seven pigs, and a mature sow eight pigs, to weaning age. Under New York State conditions a herd of 10 sows should raise at least 15 litters a year. The pigs in these litters should average at least 30 to 40 pounds each in weight at weaning time, at eight weeks of age. Healthy pigs, full-fed satisfactory rations, should weigh about 150 pounds each when five months old and 200 or more pounds each when six months old.

The raising of swine requires no superior skill or intelligence, but successful pork production does demand attention to a number of details. Any one of these details may seem unimportant in itself, but it is the careful attention to all that assures successful swine production.

The development of heavy-yielding seed-corn varieties has made it possible for New York farmers to produce corn cheaply enough to market the grain through hogs. Cheap feed is essential for profitable pork production.

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Swine Production

JOHN P. WILLMAN

THE hog excels all other farm animals in the economy with which he converts feed into edible flesh. He is a heavy consumer of grain and concentrates but also can eat, and thereby efficiently convert into meat, such feeds as garbage, cooked cull beans, cooked potatoes, apples, soiled feed or foods, waste from the garden, skim milk, buttermilk, whey, and grains that otherwise cannot be disposed of profitably. He can eat considerable quantities of alfalfa, clover, or soybean hay, and also grasses and forage crops.

The average number of pigs on New York farms on January 1 from 1942 to 1951 was about 269,000 head. The average farm value of the swine inventory on January for the 10-year period 1942 to 1951 was \$6,294,000, but the preliminary farm value for 1953 was \$5,191,000. These figures refer to the number and value of the pigs on farms on January 1 for the years given but do not show the importance of the swine industry in New York State in terms of pigs raised. An average of 28,000 spring litters and 18,000 fall litters were farrowed on New York farms in 1952 and a total of 342,000 pigs a year were saved.¹ The number and value of pigs raised in New York State varies considerably from year to year.

TYPES OF SWINE PRODUCTION

Most of the individual swine enterprises in New York State are small, and most pork producers feed only a few pigs for home use. Many more farmers would find it profitable to grow and fatten pigs for home consumption and by so doing would save feeds and by-products that otherwise would be wasted. On many farms the waste products from the home, garden, and dairy furnish much of the feeds for one or more pigs. The surplus pork produced on the farm usually finds a ready market in the neighborhood or in near-by villages or cities as dressed pork or in the form of cured-

¹ From *Agricultural Statistics*, Bureau of Agricultural Economics, United States Department of Agriculture, 1953.

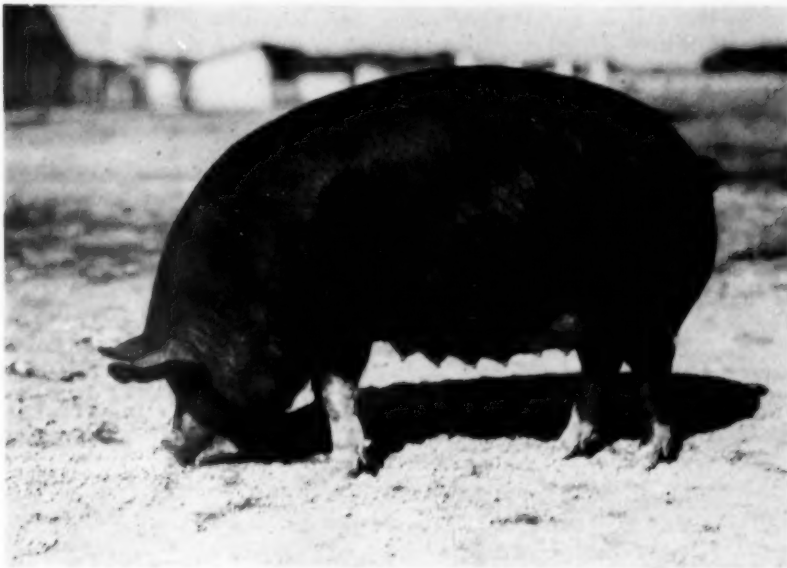
pork products. The farm families who raise their own pork have more meat to eat and at a lower cost than if they bought it at retail prices.

A number of farmers in New York State breed from one to several sows a year and sell their pigs as feeders at weaning time; others prefer to grow and fatten a few or all of the pigs. Increased production of corn and other grain should tend to cause an increased interest in pork production.

Many New York farmers feed garbage. The garbage feeder should be not too distant from the supply. Such feeders keep larger herds than do the other swine producers in this State. Garbage is an excellent feed, and pork of good quality is produced by pigs that are fattened on it. Much garbage is wasted that could be fed to pigs. (Pages 33 and 34.)

The breeding of purebred swine is not done on a large scale, but a number of breeders report satisfactory returns from this type of enterprise. The purebred breeder has the opportunity to follow any of the various types of production and, in addition, is able to sell breeding stock at better-than-market prices.

The markets in the East are good for both fresh and cured pork, and usually many buyers are willing to pay a premium for a good product.



Photograph from the Lynwood Farms

Figure 1. This Berkshire sow is excellent in type. She has length and depth of body and is standing on good bone. She has balance and smoothness of form.



Photograph from the Ontario Agricultural College

Figure 2. This Yorkshire boar is a bacon-type hog. Note the length and depth of body. The carcasses produced by typical individuals contain less fat than carcasses from lard-type hogs. Finished market pigs show more depth of body than is exhibited in this boar.

Swine growers have learned that it pays to raise the type of hog that will yield a superior product. The greater use of freezer lockers or home freezer units has increased the demand for locally grown pork. Good salesmanship, backed with a good product, is just as essential for success with swine in the East as are good practices in feeding and management.

TYPES AND BREEDS OF SWINE

The two distinct types of swine are the lard type and the bacon type. Duroc, Poland China, Chester White, Hampshire, Berkshire, and Spotted Poland China are the most common of the lard-type breeds. Yorkshire and Tamworth breeds are of the bacon type. The Berkshire breed belongs to the lard type, but more closely resembles bacon hogs in type than do the other lard-type hogs.

The Duroc and the Tamworth are red in color. The Tamworth has a longer snout and head than the Duroc and has erect ears, while the Duroc has drooping ears. The Chester White and the Yorkshire are solid white in color. The Chester White has drooping ears, and the Yorkshire has erect ears. Their heads also differ somewhat in shape. The Berkshire

and the Poland China are black with six white points; the white usually is confined to the feet, face, and tail. The Berkshire has erect ears, and the Poland China drooping ears. The Spotted Poland China differs from the Poland China principally in the amount of white and black on the body. The Spotted Poland China has much more white than has the Poland China. The Hampshire has erect ears and is black in color with a white belt around the body. The belt should include the shoulders and the front feet and legs.

THE BREEDING HERD

CHOICE OF BREED

The selection of a breed of hogs is largely one of personal preference. No one breed of hogs is best for all conditions; in certain localities one breed may be more common than another. Usually the best breed for any one man is the breed he likes best. He will get more enjoyment from working with this breed than with one he does not like.

The *type of the individual hog* is more important than the breed, and there is much variation in type within a breed. The type selected should be the one that will prove to be most profitable to the breeder. A sow, to be a profitable investment, must produce large litters of pigs that will make rapid and economical gains and will at the same time, when offered for sale, meet the requirements of *packer, butcher, feeder, or breeder*.

Forty or more years ago the very wide, thick, short-bodied, short-legged, chuffy, or close-to-the-ground, type, showing extreme refinement of bone, head, ears, and hair, was in demand. Occasionally one finds a farmer who still prefers this type, but today most breeders choose a type that has proved to be more profitable. The sows of this small, chunky type had small litters, and their pigs usually were too fat when they reached the desired market weights.

The present-day type of hogs should have length of body, medium length of leg, and large, but not too coarse, bone. They should have, also, good depth and capacity of the chest and middle to insure constitutional vigor and good feeding qualities, and should show smoothness of form. The long but deep-bodied, *intermediate*, or meat type of sow produces large litters, is a good milker, and her pigs make economical gains and yield desirable carcasses.

This stretchy type of hog may be developed into a so-called rangy or very rangy type. It is true that medium length of leg and length of body are desirable, but these characteristics must be accompanied with a depth, width, and fullness of middle and a large heart girth to insure good feeding



Figure 3. A prolific sow is usually a money maker. Note the guard rail on the left partition and the electric pig brooder in the right rear corner of the pen.

qualities and good constitution and vigor. Pigs of this type make fast and economical gains and are fat at the desirable market live weights of from 190 to 250 pounds. The narrow and shallow-bodied type usually must be carried to heavier weights before they are fat enough to yield desirable carcasses. On the other hand, the short-bodied and short-legged type are fat when they weigh from 150 to 160 pounds. The intermediate between these two extremes seems to be the most desirable type. One should prefer the intermediate or meat type that borders slightly on the rangy rather than the shorter-bodied type.

Many prospective buyers express a definite preference for a hog with a short snout, but too few buyers insist upon getting a pig or hog that has length and depth of body and large, plump hams. There seems to be an increasing interest in the Eastern States for hogs of the bacon type or those that do not produce an excess of fat.

ESTABLISHING THE HERD

No one way of founding a breeding herd of swine is best. The method that may suit one person may not be the best one for another. It makes little or no difference whether young pigs or bred sows or gilts are purchased, but it is always good practice to buy from a reputable breeder. If possible, purebred animals of the proper type should be used to establish a herd; at least the boar should be purebred.

The buyer when selecting pigs or hogs for breeding purposes, should try to choose those with good feet and legs, and the sows or gilts should have at least 12, and preferably more, well-placed teats. Animals with inverted-nipples, weak top-lines, coarse shoulders, flabby jowls, crooked legs, and weak pasterns should not be selected for breeding stock.

Other important considerations in selecting breeding stock are the prolificacy of the sow and her ability to raise large litters. Every breeder is interested in raising as many good pigs to the litter as possible. The boars and sows selected should come from large litters and also should have parents that were from large litters. This should also be kept in mind after the herd has been founded and when gilts are selected for replacements or for sale as breeders. The owner who keeps records on his herd has no difficulty in selecting gilts from his most prolific sows.

The Extension Service of the College and breed associations are encouraging swine breeders to develop outstanding sow herds through their *Advanced Registry or Record of Performance* programs. Recognition of superior breeding stock is based chiefly upon the litter weights of the suckling pigs.

CARE AND MANAGEMENT

Care of the boar

Many times the boar is the most neglected and abused animal on the farm. If the old saying that "the boar is half of the herd" is true, then he should at least be given the feed and care he deserves. Although well fed, the boar may be confined to such small quarters that his efficiency is reduced because of over-fatness and a lack of exercise. A one-fourth- to one-half-acre lot, with a small colony house at one end and a feed trough at the other, makes ideal quarters for a boar. A plan of this type forces the boar to take exercise and to get out into the sunshine. The house or shelter need not be expensive or warm, but is satisfactory if it is clean, dry, well bedded, and protected from the prevailing winds and the weather.

Rations suitable for pigs from 75 to 125 pounds in weight, as shown on pages 48 to 50, are recommended for boars more than six or seven months of age. The boar should not be fattened, but should be kept in good thrifty condition. The condition of the boar should be the feeder's guide as to the amount to feed. The boar usually continues to grow until he is two or three years old.

Boars under six months of age should not be used for breeding. Eight- or nine-month-old boars may be expected to give 10 or 15 services in a season, and should not breed more than one sow a day. A yearling boar should give twice as many services as the eight- or nine-month-old pig, and

a two-year-old boar twice as many as a yearling boar; that is, from 40 to 50 matings in a season for a two-year-old boar. The boar that is too fat may not be able to give satisfactory service.

The boar usually has no direct influence upon the size of litter he may sire if he is in a good thrifty condition. When his vitality is low, the sperm may be so weak that only part of the eggs produced by the sow are fertilized and as a result she may have a small litter. He does transmit his characters which may in part govern his offsprings' ability to produce large litters.

Breeding season

Well-grown gilts come in heat and will take the boar when from three to five months of age, but they should not be bred until they weigh 180 pounds or more and are from seven to nine months of age. Well-developed gilts should produce their first litters when about one year old.

Gilts or sows usually remain in heat for three days and if not bred will return in heat again in about twenty-one days. They should be bred on the second or third day of the heat period, for it is believed that larger litters result from breeding during the late rather than during the early part of the heat period. If the sow is still in heat 24 hours after being bred, it may be wise to breed her again if the boar is not doing heavy service.

It is better to bring the boar to the sow or the sow to the boar than to allow the boar to run with the sows all of the time. One good service is as good as half a dozen at that time. This method of breeding conserves the energy of the boar and in large herds is a help in record keeping. Occasionally, a breeder allows a boar pig to run with his sows. Too often this proves unsatisfactory, because the boar pig is not an equal match for an older sow not in heat, and sometimes may be so severely punished that he may be shy of the older sows for a time.

A sow or gilt may be expected to produce her litter of pigs in from 112 to 114 days after a fertile mating. The gestation period of a few sows or gilts sometimes is a little longer than this. A simple and rapid way to calculate when a sow may be expected to farrow is to figure three months, three weeks, and three days from the date she is bred.

When pigs should be farrowed

The breeder who is interested in raising two litters a sow each year usually prefers the spring litters to be farrowed in March and the fall litters before September 15 or 20. In most parts of New York, the weather is more favorable for farrowing in April and August than at any other time of the year. Experience has shown that the pigs farrowed after October 1, because

of unfavorable weather conditions, are not so desirable as the August or early September farrowed pigs. The use of the farrowing stall or crate and pig brooders make it easier to raise pigs in cold weather than it is without this equipment. The farrowing crate is better than the stall for use in cold weather and when the barns are cold.

Two litters a year

On some farms it is best to raise only one litter a year from each sow, but usually two litters a year are best. It is difficult or sometimes impossible in large herds for each sow to raise two litters, but it is reasonable to expect a herd of 10 sows to raise 15 or more litters a year. Fall pigs require warmer quarters and need more attention than do spring pigs, but satisfactory gains may be obtained from fall pigs if they are fed adequate rations and are given a good start before cold weather.

Usually there is little or no excuse for a sow to work for her owner only one-half of the time. Some breeders produce pigs from gilts and then sell these gilts after the litters are weaned.

Winter management

The sow that is closely confined in a hog house during the winter months is not able to give so good an account of herself at farrowing time as is the one that has been forced to take plenty of exercise. The sow that is exercised is not so apt to become too fat, she farrows more easily and recovers more quickly after farrowing than the one that is confined. In addition, she ordinarily produces a more vigorous litter of pigs. When the boar is given plenty of exercise, he is less apt to become too fat and is a surer breeder than when not exercised.

It pays, especially when a number of bred sows or gilts are kept on one farm, to sort them into groups according to their requirements, condition, and disposition. When this is done, the sow has a better chance of getting the feed she needs. The big, fat, or "bossy" sows should be kept in one lot, and the gilts and small or very thin sows in another.

Dry, clean, well-bedded, and well-ventilated quarters are ideal for the breeding herd. It is not necessary to provide warm quarters for the sow herd or for mature hogs, but the warmest and most protected buildings should be provided for the fall pigs. A well-bedded colony house with a door opening to the southeast, or at least to the direction from which the prevailing winds do not come, is satisfactory for the breeding herd in winter. The door may be open or the opening partly covered with burlap. In some parts of New York State it would, no doubt, pay to provide warmer quarters. The feed

trough should be about 75 to 100 yards from the sleeping quarters. A hay rack containing alfalfa or clover hay should be placed halfway between the feed trough and the sleeping quarters. This arrangement forces the sows to take the needed exercise. The growing and fattening pigs should have access to only a small outside lot in which to exercise. The sleeping quarters or beds for all classes of swine should be cleaned whenever they need it and should not be allowed to become damp or dusty.

Feeding pregnant sows and gilts

Mature pregnant sows use their feed to maintain their bodies and also to supply material to the growing embryos. In addition to these needs the bred gilt must have feed for her own body growth. Bred sows and gilts should be fed so that they will make the greater part of their gain in weight during the last six or eight weeks of the gestation period. When they are fed in this manner, they will take plenty of exercise and will be less apt to become too fat.

A rule for feeding bred sows and gilts may be suggested, but it should not be followed blindly. The condition of the sow should serve as the feeder's guide. Ordinarily, a thin sow will need from 1.0 to 1.25 pounds of feed daily, and a bred gilt from 1.75 to 2.0 pounds of feed daily, for each 100 pounds of body weight. In addition to this they should have free access to good-quality alfalfa or clover hay supplied in a rack. Usually this



Figure 4. In this winter scene, the pregnant sows are in the foreground, and the colony houses are about 100 yards from the trough.

amount of feed should be increased gradually as the gestation period progresses. (Suggested rations are given on pages 47 to 50). Unbred sows or mature boars should not be allowed to become too fat. They should be in thin to medium condition at the beginning of the next breeding season. An over-fat sow or boar may look well but may be a disappointment as a breeder. Such a sow may fail to become pregnant, may farrow a number of dead or weak pigs, or may be so clumsy that she will injure or kill some of her pigs. A fat boar may be a slow breeder or may be too heavy for breeding young sows.

The watering of the breeding herd in winter usually is a difficult problem. In mild weather, the water may be supplied in heated automatic waterers, but these may freeze in extremely cold weather. When it is so cold that waterers cannot be used, or when waterers are not available, the concentrate feed may be fed in the form of a moderately thick slop so that the sows get the water they need. Too thin a slop freezes in the trough. The sows in the Cornell University herd usually are given their feed first in the dry form and then a somewhat greater volume of water is poured on this feed while they are eating. This system seems to supply enough water for the breeding herd. Flat-bottomed troughs about 10 to 12 inches wide and 6 inches deep are recommended for the breeding herd.

Pregnant sows and gilts may be *hand-fed* once or twice daily or may be *self-fed*. Ground alfalfa or clover hay and other bulky feeds must be mixed with the grain or other concentrates to prevent the sows or gilts from getting too fat when self-fed. The mixture may contain from 20 to 30 per cent of hay when it is self-fed. It may be necessary to change the proportion of hay during the winter to keep the sows or gilts in the desired condition. The self-feeders should be kept properly adjusted to prevent feed wastage. Self-fed sows should have access to water either in suitable waterers or twice a day in a trough.

Summer management

In summer, if pasture is available, the feeding and management of the breeding herd is more simple and less expensive than in winter. In the summer the sows need little shelter and little or no straw. The sleeping quarters, however, should be kept clean and dry. Shade, either natural or artificial, may be provided. They should have access in summer to drinking water at all times.

The breeding herd that is kept in dry lot or does not have access to pasture in summer should be fed the same kinds of feeds as would be fed in winter. Good pasture, however, enables the sow to make the necessary gains on much less feed than is needed when she is in dry lot. Sows that have access to

alfalfa, rape, or other good pasture need little or no grain the first half of the gestation period. They need only about one-half to two-thirds as much grain for the latter half of the gestation period as they would need if they were in dry lot. The use of pasture enables the sow herd to farrow strong and vigorous pigs.

Care of the sow at farrowing time

The farrowing pen

A few days before farrowing, the sow should be put in a clean farrowing pen. (Suggestions and reasons for cleaning the farrowing pen are given on pages 20 to 22). The pen should be no less than 7 by 7 feet in size. Pens 7 or 8 feet wide and 9 or 10 feet deep are a more satisfactory size. Smaller pens should be used only when the sow has access to an outside yard where she may be fed. Guard rails should be placed around the walls about 8 or 10 inches from the floor and at the same distance from the wall. Too low guard rails may be more harmful than helpful. Guard rails properly constructed protect the pigs from being lain on by the sow, especially when the pigs are only a few days old. The use of electric brooders, or just pig nests where electricity is not available, saves pigs and makes them more comfortable. Electric heating bulbs may be used in place of brooders but they must be guarded to prevent being broken by the sow. They may cause fires if they are placed too near the floor.

The floor of the farrowing pen should slope about 3 or 4 inches in 10 feet to provide good drainage. The pen at farrowing time should not be heavily bedded. Straw that has been cut in short lengths or chaff is excellent. When too much bedding or long coarse straw is used, the pigs become tangled in it and may be lain on by the sow. It is easier to keep the floors dry when short-cut straw, chaff, shavings, or sawdust is used.

Feed before farrowing

The sow gets little exercise after she has been placed in a farrowing pen in the barn, and should, therefore, be given only about one-half to three-fourths of her normal amount of feed. At this time, the ration may be made bulky by adding ground alfalfa. As much as one-third of the sow's ration may be made up of wheat bran, to keep her bowels moving regularly. If she becomes constipated, a handful of linseed meal or a small amount of Epsom salts in her slop daily will usually remedy this trouble. The amount of feed should be further reduced at the meal before farrowing, but the sow should be given all of the clean fresh water she wishes to drink. If she seems very hungry, it may be wise to give her a double handful of feed to quiet her.

Farrowing

Few sows need help at farrowing time, but the careful hog man knows the breeding dates and watches his sows at farrowing time. The sow's udder usually fills up, she becomes restless and spends a great deal of time walking around the pen, and makes her nest a few hours before she is ready to farrow.

The broken navel cord should be dipped in tincture of iodine immediately after birth. This will help to prevent losses due to navel infection. *The pigs should be allowed to suckle as soon after birth as possible.* If the sow is extremely nervous, the first feeding may be delayed for about an hour when all of the pigs may be placed with the sow.

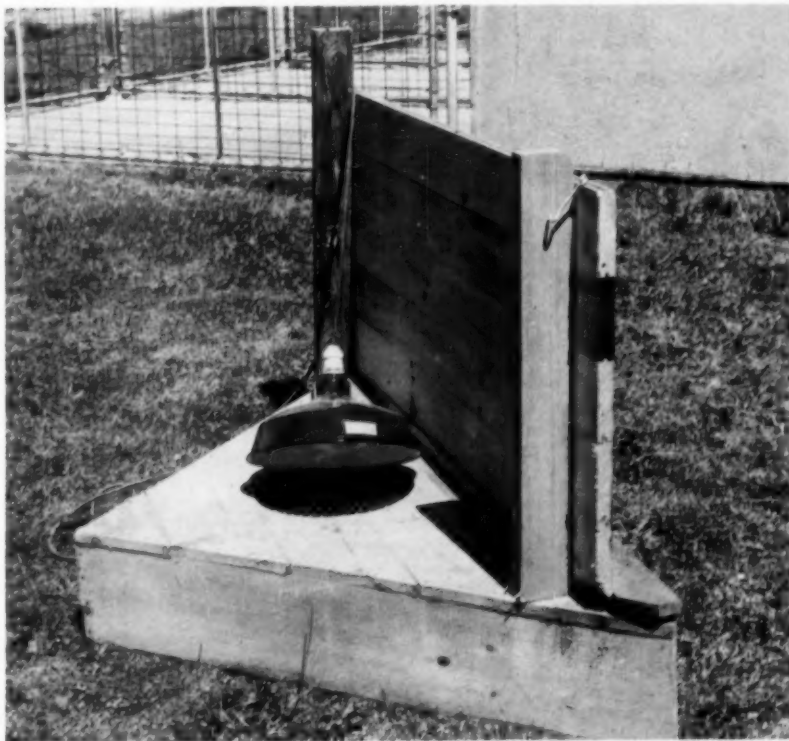


Figure 5. Electric pig brooders provide comfortable conditions for baby pigs and protect them from injury by a careless sow. The pigs will use a brooder in warm or cold weather. A 100-watt bulb should be used in cold weather but a 60-watt bulb is enough in warm weather.

It is a good plan, especially in cold weather, to dry the new-born pigs with a burlap sack or cloth as soon as they arrive. In very cold weather, if the pen is not equipped with an electric pig brooder, it may pay to put the new-born pigs in a covered box or basket. A jug of hot water or a few hot bricks, wrapped with burlap to prevent burning the pigs, will keep the little fellows warm. Under ordinary conditions this extra heat is not needed. This special care is not needed when farrowing crates are used.

Usually, the pigs may be allowed to remain with the sow after she has finished farrowing. It may be best in some cases to keep the pigs away from the sow the first day or until they are strong enough to take care of themselves, but they should be placed with the sow long enough to nurse about every two or three hours day and night.

For best results it is essential that the attendant and the sow be accustomed to each other before farrowing time. A sow that is nervous and afraid of her attendant may be cross after farrowing.

Occasionally, the pigs may show no interest in nursing even though they are from 1 to 3 days old. A teaspoonful of a solution of half sirup or sugar and water given by mouth seems to stimulate an interest in nursing.



Figure 6. A farrowing stall may be used to good advantage for farrowing in a colony house or in a central hog house.

The farrowing crate

The use of the farrowing crate is recommended for all swine breeders except those who own only a sow or two. A properly constructed farrowing crate greatly reduces pig losses at farrowing time. Its construction prevents sows from laying on the pigs and prevents the pigs from becoming chilled. The sows or gilts are placed in the crate when it seems quite certain that they will farrow within a few hours. The sow and litter may be kept in the crate for a few hours or possibly for a day or two after farrowing if she is nervous and slow to accept her pigs. The sows may become overheated in warm weather if the crates are not properly ventilated. The number of sleepless nights and the number of trips to the barn during the farrowing seasons are greatly reduced through the use of this piece of equipment.

A farrowing stall (figure 6) may be used to good advantage if the barn space is small. They require an electric pig brooder or one or more 250-watt heat bulbs to prevent chilling the pigs.

Needle teeth

At birth each pig has eight, four on each jaw, small tusk-like or needle teeth. These teeth are not a source of trouble to the pig himself, but they do considerable damage to other pigs with whom he may fight or play. Some herdsmen insist that these needle teeth should be cut off before the pigs are placed with the sow to nurse. Diagonal cutting pliers or regular pig-teeth cutters may be used to cut these teeth. In cutting them one must make a clean break, without leaving any jagged edges and at the same time without injuring the jaw or gums of the pig. Jagged edges may do considerable harm to the sow's teats. If the teeth are broken off or splintered beneath the gum or if the gum is injured, it opens an avenue for infection in the mouth of the pig.

Care of the sow and litter

Feeding

Beginners are apt to feed the sow too liberally during the first few days after farrowing. Sows should receive *plenty of water* but *no grain* or concentrates for from twelve to twenty-four hours after farrowing. The chill may be taken off the water in extremely cold weather. When the sow is nervous and seems hungry, a handful of wheat bran thrown on the water in the hog trough may quiet her. The first feed should be laxative in nature, and only a double handful should be given. The inclusion of wheat bran, ground oats, and ground legume hay adds bulk to the ration and helps to

keep the sow in a laxative condition. The grain should be increased very gradually. When too much feed is given, the sow may milk too heavily and the young pigs may have scours or the sow may develop a caked udder. The sow can be put on full feed about ten days or two weeks after farrowing. The amount of feed she should get at this time depends upon the size and condition of the sow and also upon the number of pigs she is nursing. Two weeks after farrowing a 400-pound sow should eat between 10 and 12 pounds of grain and other concentrates daily. From this time on liberal feeding is essential to the maximum growth of the litter.

Two ways of feeding sows with suckling pigs are the hand-feeding method, where the sow is fed either two or three times a day, and the self-feeder method. When the self-feeder method is employed, both sows and pigs are given access to feed in a self-feeder at all times after the pigs are about 14 or 15 days old and until they are weaned. This is a satisfactory way to feed the sow and litter, especially when two or more sows are running in one lot. There is no fighting at the trough and both the sows and the pigs get all they need to eat. This method, however, is not recommended for sows that are nursing only a few pigs, for such sows are apt to become too fat.

Pigs will start to eat grain when they are from two to three weeks old. When the sows and the pigs have access to a self-feeder, the pigs can eat grain whenever they wish. When the sows are hand-fed, the pigs should have access to grain in a creep. The creep should be so built that the pigs may enter and eat grain or other feed at will, and so built that the sows cannot reach the little pigs' feed supply. The pig creep trough shown in figure 8 gives excellent results with suckling pigs that are raised in dry lot. The suckling pig that has an opportunity to eat grain will be larger at weaning time and will show less setback after he is weaned than will a pig that has not been given this opportunity. Although a home-mixed concentrate or grain mixture suitable for young growing pigs can be used satisfactorily, a commercial creep feed or "pig starter" which is supplemented with vitamins, minerals, and antibiotics should give superior results. The pigs may eat more feed if some shelled or cracked corn is used in these mixtures. Young pigs also will eat "rolled" or hulled oats as soon as any other feed. Many producers like to include hulled oats up to 25 per cent or more of the ration offered to pigs under 50 pounds live weight. The pigs also can make good use of skimmilk or buttermilk which may be fed in the creep. The inclusion of 10 to 15 per cent of brown sugar improves the palatability of the ration for suckling pigs.

It pays to give the pigs a good start whether they are raised for pork or for sale at weaning time. A pig that has been properly fed and handled during the suckling period is a better candidate for the feed lot than is one that has not been so handled.

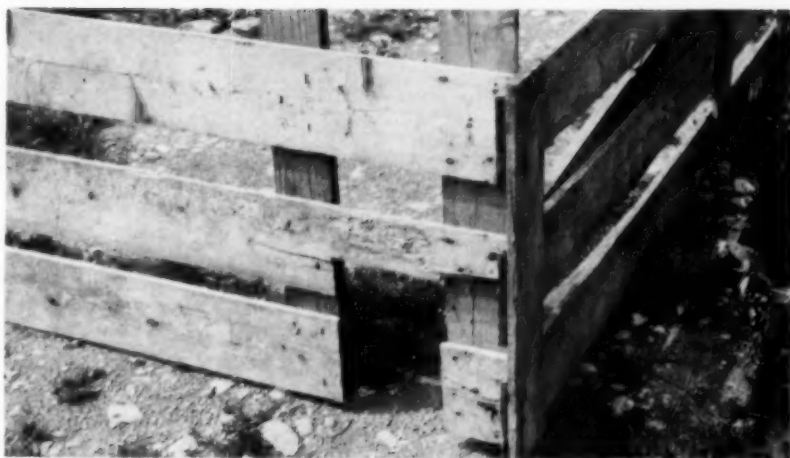


Figure 7. A pig creep like this makes it possible for the pigs to have free access to their own feed supply.



Figure 8. A creep feeder built so the small pigs have their own supply of feed.

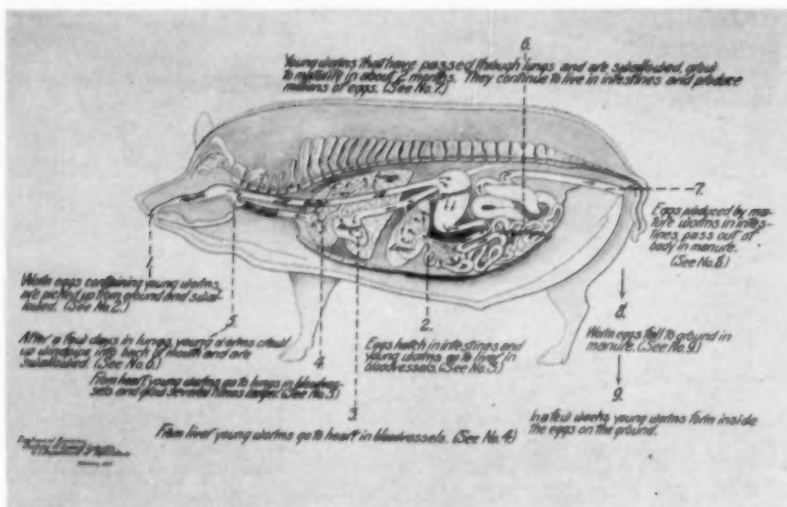


Figure 9. This is the roundworm's journey through the pig.

Importance of sanitation

Some pigs are small because their parents are small and of inferior breeding stock; others are small and unthrifty because they have been improperly fed; but more pigs are runts because they are heavily infested with internal parasites.

The roundworm is one of the most common internal parasites of pigs. A hogman who has kept swine for many years has suffered large financial losses from the roundworm. Examinations of slaughtered hogs have shown that one out of every three hogs of breeding age are hosts or carriers of these worms.²

Roundworm eggs may be found in the dust and dirt in the hog pen and in the soil in the hog lots or pastures. These eggs before incubation may live in the soil or manure in the hog lot for a year or more. Freezing, thawing, drying, and soaking have little or no effect on them. Ordinary dip solution seems to have little or no effect on them.

Roundworm eggs when first released will not hatch even if they are swallowed by the pig. In this stage they pass through the small pig without doing any harm. In a few weeks or months, depending upon the weather conditions, the egg develops into a stage at which it contains a tiny worm, and it is in this stage that it is highly infectious if the pig swallows it.

² Growing healthy hogs. By R. K. Bliss. Iowa State Coll. Agr. Exp. Sta. Ext. Bul. 133, p. 4. 1926.

When the incubated egg is swallowed, it passes to the small intestine where it hatches. The young worm passes through the wall of the intestine, is carried by the blood to the liver, from the liver to the heart, and then to the lungs. After spending about ten days in the lungs, it breaks through the cells and is coughed up into the throat of the pig. It is this stage of the roundworm that causes many small pigs to cough. The worm at this stage is about 1/15 to 1/20 inch long. After it is coughed up into the throat, it is swallowed by the pig and then passes on to the intestines where in about two months it develops into a mature worm 8 or 10 inches long. The mature female worm lays millions of eggs which pass out in the manure. When one understands the life cycle of the roundworm and at the same time knows the food habits of the hog, he realizes how easy it is for young pigs to become infested with roundworms.

The McLean County system of swine sanitation, which is outlined in the following paragraphs, is effective in preventing losses caused by worms and by necrotic infection. This system was developed by the United States Department of Agriculture in McLean County, Illinois. It has proven to be so successful that it is being followed by many swine breeders throughout the United States.

This system of sanitation is not a cure but it is a preventive measure. When it is properly carried out, it protects the young pigs from becoming infested with roundworms as well as with other species of worms. It greatly reduces losses due to necrotic infection, or the so-called filth-borne diseases, such as sore mouth, necrotic enteritis, and others.

The four simple but necessary steps that must be carried out to make this system effective are:

1. Clean the pens

All dirt, dust, and litter should be removed from the farrowing pens. Then the floors and the walls for 2 feet or so up from the floors should be thoroughly washed with boiling water. One pound of lye should be added to each 30 gallons of water. After the pen has been thoroughly scrubbed, it should be sprayed with a solution which is made by adding 1 pint of cresol solution to 4 gallons of water. Any reliable disinfectant, when mixed according to directions, may be used in place of the cresol solution. The lye helps to loosen the dirt, the boiling water kills some of the roundworm eggs, and the disinfectant kills the germs of the infectious diseases. Sometimes the farrowing pens open into small outside enclosures. It is satisfactory to turn the sow and litter out into these enclosures if the enclosures are covered with a wood or concrete floor that also has been thoroughly cleaned.

2. Clean the sows

The dirt on the sow's sides should be brushed off with a stiff brush, and the udder, feet and legs, and underline should be washed with plenty of soap and water before she is put into this clean pen. A chunk of dirt remaining on the underline of the sow may contain enough worm eggs and disease germs to stunt the pig that swallows it.

3. Haul sow and pigs to pasture

The sow and the pigs should be hauled (not driven) to a pasture where no pigs have been kept for at least one year. This field should be one that has been cultivated since last used by hogs. The sow and pigs should not be driven over ground that has recently been used by swine.

4. Keep pigs on "clean" pasture

The pigs should be kept on this "clean" pasture until they are at least four months old or weigh about 125 pounds. Pigs of this age are harmed less by roundworm infestation or necrotic infection than are younger pigs. After they are returned to old hog lots, they should be fed in hog troughs or on clean concrete feeding floors. The sows should be moved to other lots when their pigs are weaned. Methods of "worming" pigs are discussed on pages 62 and 63.

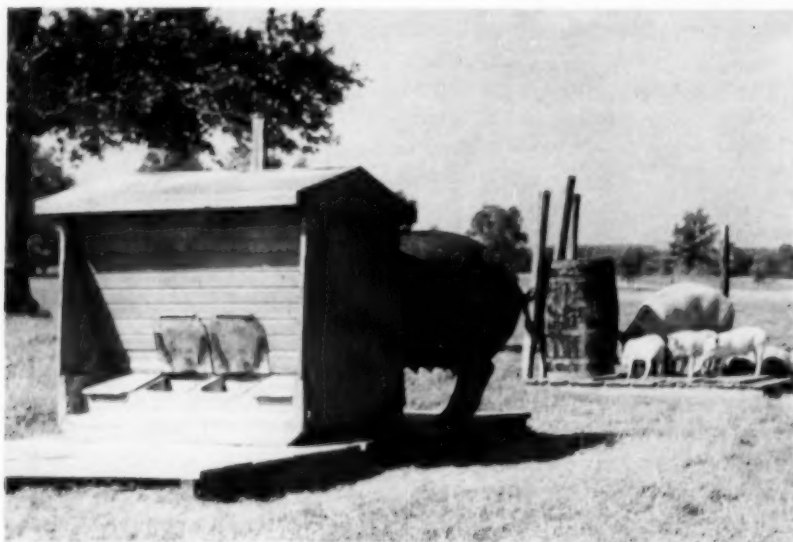


Figure 10. Pastures save feed and provide sanitary conditions for swine.

Pasture

It pays to get the sow and litter on clean pasture as soon after farrowing as the weather will permit. In a few places, even as far north as New York State, it may be more convenient and desirable to allow the sow to farrow in a colony house in a "clean" pasture. Because of weather conditions in this State, it is not possible to allow early spring or late-fall pigs to be farrowed outdoors. Usually, early spring pigs must be farrowed in the barn and must be kept there until the pasture is advanced enough or until the weather is suitable for them to be turned out of doors. Early fall-sown rye is excellent pasture and it is ready for heavy grazing early in the spring. It is not always possible to give the late-fall-farrowed pigs access to pasture. Pigs raised indoors on clean concrete or wooden floors, so that they will be reasonably free from roundworms, may develop a disease known as *anemia*. A description of an anemic pig and methods of preventing this disease are outlined on pages 59 and 60.

Shade and water

Artificial or natural shade should be provided for pigs on pasture. The water supply should be near the self-feeders. Pigs fed dry feeds make many trips to the waterer. Hand-fed pigs are given water at feeding time.



Figure 11. This colony house, 7 feet by 10 feet, provides shade and shelter for hogs in summer and if well-bedded is suitable shelter for the breeding herd in winter.

Weaning the pigs

It is best to wean the pigs when they are about eight weeks of age, but sometimes it is necessary, especially when the producer is trying to raise two litters a year, to wean them at seven weeks of age. The pigs that have been allowed to suckle the sow until they are eight weeks of age are so accustomed to eating grain that they are not set back at weaning time.

Two common methods are employed for weaning the pigs. One method consists of weaning a few pigs at a time. The larger pigs are weaned first and a few more of the remaining stronger pigs a little later. With this method the small pigs are allowed to nurse a little longer. The second, and more common method, is to wean all of the pigs at once.

The attention the sow receives at weaning time often may determine her usefulness. It is best to reduce the feed of the sow for a few days before weaning. The rations should again be reduced immediately after weaning. It is more difficult to dry up the sows that have access to pasture than those that are fed in the dry lot. If the sows and pigs have access to self-feeders on pasture, creep panels should be erected around the self-feeder three or four days before the pigs are weaned. The creep keeps the sows away from the self-feeder but allows the pigs to eat all they wish. The sows will be hungry but will obtain enough nourishment from the pasture during this short period. A supply of fresh water should be provided.

Care after weaning

The udder of a heavy milking sow may fill up and become distended within a day or two after the pigs are weaned. Such a sow should be returned to the pigs for a few minutes every second day or so until she dries off. The feed may be increased as soon as the milk flow has ceased. The sow usually comes in heat a few days after weaning. It is necessary that the sow be bred at this time if two litters a year are desired from her.

Sometimes, the sows that are heavily fed will come in heat before their pigs are weaned. It is believed that the practice of keeping the sow away from the pigs during the night only for several consecutive days, when the pigs are from 5 to 7 weeks old, induces the sows to come in heat.

All pigs, whether they are to be fed for the market, to be kept for breeding, or to be fitted for the show, should be given plenty of feed and good care immediately after weaning. If rapid and economical gains are desired, then all pigs that are intended for slaughter should be given all they will eat of a well-balanced ration until they reach market weights. The pigs that are to be saved for breeding should be fed liberally until they weigh about 150 pounds, and from that time on they should not be fattened but should be fed to assure maximum development.

FALL PIGS

It is desirable to have fall pigs farrowed before September 15. Early fall-farrowed pigs will have the size and vigor necessary to withstand the cold weather. When cold weather sets in, they will be busy feeding when their younger pen mates will spend most of their time trying to keep warm. It is a discouraging sight to see young, fall-farrowed pigs with rough coats and humped backs huddled in a corner doing their best to keep warm. Fall pigs that are farrowed in August or early September will make satisfactory gains if they are "pushed" from the start and if they are kept free from worms. Not only should they be properly fed but they should be housed in dry, comfortable quarters. Ten or 12 square feet of floor space in the barn and a little more than this amount of space in an outside lot is needed for a 200-pound pig fed in dry lot. A few New York farmers still believe that it is not possible to raise fall pigs satisfactorily, but modern feeding practices, however, have made this belief erroneous.

Numerous experiments, by many workers at several experiment stations, have shown that fall pigs make excellent gains without any dairy by-products whatsoever if fed rations that supply plenty of vitamins and minerals and the right kind of protein. Especially good results have been obtained when the following so-called "trio" mixture of protein-rich feed has been used to supplement grain. The "trio" mixture consists of: tankage or meat scraps, 50 pounds; linseed meal, 25 pounds; and ground alfalfa hay, 25 pounds. Fish meal may be substituted for the tankage or meat scraps in this mixture, and soybean oil meal or cottonseed meal for the linseed meal. Clover or soybean hay may be used in place of the alfalfa hay. For pigs in dry lot this supplemental mixture may be self-fed in one compartment of a self-feeder and corn or yellow hominy feed may be fed in the other compartment, or the concentrate mixtures (pages 49 to 53) may be self-fed or hand-fed.

Concentrate mixtures containing a total protein content of 35 to 40 per cent may be mixed with grain or other swine feeds to produce rations that are suitable for the various classes of swine (page 51).

It is important to include green, leafy, field-cured legume hay in the ration of fall pigs, and of other hogs fed in dry lot, to furnish the nutrients supplied by pasture. From 5 to 10 per cent, by weight, of legume hay should be included in the ration for growing and fattening pigs. Hay is an exceedingly important feed for all pigs that do not have access to pasture. The hogs in the breeding herd may have a larger percentage, from 10 to 30 per cent, of hay in their rations. It is a good plan to give the breeding herd access to legume hay, supplied in a rack. The racks should be constructed so the hogs will have an opportunity to eat the leaves that shatter from the hay.



Figure 12. A central house is not complete unless it has outside pens with concrete floors.

If a limited amount of grain is fed, the hogs will eat more hay from the rack. Hay of the best quality should be used for the swine herd.

RAISING ORPHAN PIGS

If a sow gives birth to more pigs than she is able to raise, if she dies at farrowing time, or if she becomes seriously sick, the pigs may be put with other sows whose litters are of about the same age. This cannot be done successfully if the orphan pigs are placed with a litter that is a week or more old. Several days after farrowing only as many mammary glands are functioning as there are pigs in the litter. If an additional pig is placed with the sow at this time, then the new pig must fight for the possession of a teat. Neither pig gets enough to drink and one of them may die. An orphan pig may be substituted successfully for a suckling pig of about the same age that has just died.

Some swine breeders recommend that the sow be removed from the pen for about fifteen or twenty minutes after the new pigs are placed with her

litter. This procedure may not be necessary if the pigs are added when her litter is nursing. It is best, however, to spray or rub a small amount of a very weak solution of stock dip over the top line or back of all of the pigs that are to remain with the sow to make it difficult for her to detect the presence of the new pigs.

When it is not possible to transfer these young or orphan pigs to other sows, they may be raised by hand if one has enough patience. It is highly desirable, whenever possible, to allow the new-born pigs to get the first milk, or colostrum, from the mother or from another sow that has just farrowed. The colostrum seems to give them protection against certain infections. Although fresh, raw cow's milk is a good feed for these pigs, the inexperienced feeder will have better results feeding a commercially prepared "sow's milk replacement" which is supplemented with antibiotics. At first, the milk should be fed at body temperature with the aid of a bottle and nipple. Nipples known on the market as "lambs' nipples" are best for this purpose. These pigs should be fed three times daily.

The pigs may be taught to drink from a shallow pan as early as one or two days of age. Usually this may be done by immersing the snout and mouth of the pig into a shallow dish of milk. Most pigs need an average of about one quart of milk daily, especially if they are given access, at an early date, to creep mixtures. The pigs may scour if they are fed too much milk or if the bottles or other containers and troughs are not kept clean.

The pigs may become anemic if they are raised indoors and do not have access to pasture and the soil. Anemia, however, may be prevented by giving each pig, in the milk or in other feed, about $\frac{1}{4}$ teaspoonful or a little less, daily, of a solution of ferrous sulfate, such as is recommended on page 60. The recommendations for the prevention of infestations of worms, as suggested on pages 20 to 23, should be followed.

LIMITED OR FULL-FEEDING OF GROWING AND FATTENING PIGS

Pigs that are full-fed make the most rapid gains and, when labor and cost of equipment are considered, they also make the most economical gains. Full-feeding often may enable the producer to get a higher price for his pigs because he is able to get them onto the market before the months of heaviest receipts.

The person who feeds only one or two pigs to produce his home meat supply may not be interested in the most rapid gains, because he may keep pigs to utilize waste from the dairy, the barn, the garden, or the kitchen, and prefers to do his butchering during the fall or early winter. It may be best for this person to feed his pigs only a moderate amount of feed. If he

Table 1. Limited or Full-Feeding of Pigs in Dry Lot

(Average of two trials, 1933 and 1934)

Items	Full ration	Three-fourth ration	One-half ration
Average number of pigs fed	10*	10*	10*
Average number of days on feed	99.5	135.0	215.5
Average initial weight (pounds)	63.2	62.9	62.4
Average final weight (pounds)	200.2	202.2	200.0
Average daily gain (pounds)	1.36	1.00	0.62
Average total daily feed per pig (pounds) ..	5.3	3.8	2.7
Feed per 100 pounds of gain (pounds)	386.2	374.9	430.0

*One pig was removed from each lot in the first trial because of unthrifty condition.

full-feeds them, they may be too heavy to yield the most desirable carcasses. Also, the person who provides plenty of excellent pasture for his pigs may prefer to feed them a limited ration. If these pigs are fed not less than 1 pound of concentrates per head daily and not less than 2 per cent of their live weight per head daily, they will make satisfactory and economical gains, and will produce desirable carcasses if they are full-fed for about a month or six weeks before marketing.

The results of experiments with dry-lot-fed pigs at Cornell University show that full-fed pigs made the most rapid gains, but the pigs that received approximately three-fourths of a full feed required slightly less feed per 100 pounds of gain. The pigs that were fed one-half as much as the full-fed pigs failed to make satisfactory gains and required more feed to produce a unit of gain in body weight. A brief summary of the experimental work (1933 and 1934) on limited and full-feeding of pigs in dry lot is given in table 1.

PIGS MAY FOLLOW CATTLE

Many midwestern and a few eastern beef-cattle breeders and feeders make a practice of allowing pigs to run with cattle. The pigs are able to utilize much of the grain that goes through the cattle undigested. Pigs weighing from 75 to 100 pounds are good for this type of feeding. The number of pigs to follow cattle is governed by the age of the cattle and whether the corn is ground or fed as shelled corn. Usually 1 pig is allowed to 5 or 6 steers when ground corn is fed. A few more hogs should be run with the cattle when shelled corn is fed. A creep should be built in one corner of the yard

so it is possible to supply the pigs with fresh water and to give them additional feed. About one-fourth to one-third pound of tankage, meat scraps, or other protein supplement should be fed to each pig daily. They may be fed some grain if they are not gaining at a satisfactory rate.

FEEDS FOR SWINE

Swine suffer more frequently from inadequate rations than do other classes of livestock, probably because most swine, unlike other farm animals, are fed rations that consist largely of grain and they eat relatively little roughage. Numerous experiments have shown that the feed requirements of swine are relatively simple and that it is not necessary to feed unusually complicated or expensive rations to obtain the best results.

The chief components of the average swine ration are grain and other concentrates that are low in protein. These feeds are sometimes called *carbonaceous concentrates* and are those which contain large quantities of starches and sugars and relatively small quantities of protein. The starches and sugars produce energy which is either used up day by day in performing the work of the body or is stored in the animal body in the form of fat.

Since pigs grow rapidly, it is necessary that they have enough protein in the ration. Protein-rich feeds furnish the building blocks of protein, called the *amino acids*, that are necessary for building the tissues and internal organs of the hog. The supply of protein in a swine ration should be not only adequate in amount but of the right kind. As a rule, a ration consisting of the cereal grains and a protein supplement of vegetable origin, such as linseed meal or cottonseed meal, is not a satisfactory swine ration because it is deficient in certain essential amino acids. On the other hand, a ration consisting of one of the cereal grains and a protein-rich supplement, such as skimmilk, buttermilk, tankage, fishmeal, or other protein supplements of animal origin, gives excellent results when fed to swine.

Soybean oil meal that has been well heated during the process of manufacture may even serve as the sole substitute for protein concentrates of animal origin. Recent experiments at Cornell University with pigs fed in dry lot, show that this type of ration may be improved by the addition of certain trace minerals and vitamin B₁₂ (pages 45 to 47). Trace minerals, vitamins, and antibiotics are discussed on pages 45 to 47.

It is advisable to use green forage crops for swine, especially when most economical pork production is desired. Good forage crops, such as alfalfa, clover, and rape, are rich in protein and also in calcium. The protein contained in these crops supplements well the protein furnished in the cereal grains and in soybean oil meal.

Alfalfa or clover hay is an important addition to the ration fed to hogs in dry lot. These hays contain protein of good quality, and they also supply much calcium and vitamins to the ration. The average ration fed to growing and fattening pigs in dry lot during the winter months should contain from 5 to 10 per cent of ground or chopped alfalfa, while rations fed to the breeding herd may contain from 10 to 30 per cent or more of this feed. The use of hay in rations for fall pigs is discussed on page 25.

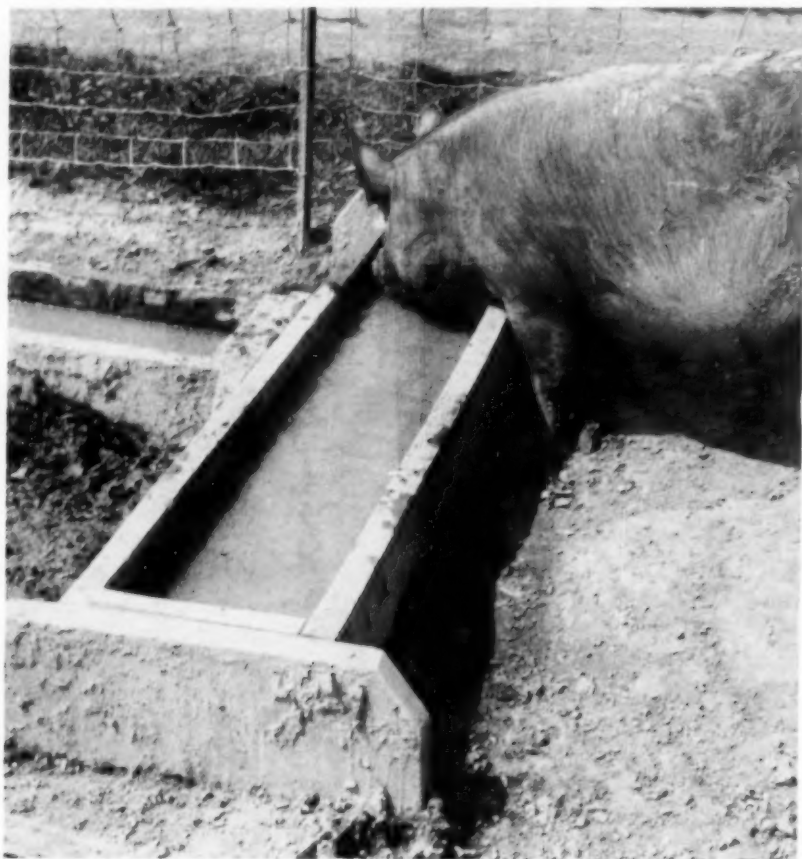


Figure 13. This flat-bottomed hog trough, made of hardwood, is a satisfactory piece of hog-lot equipment.

Grains and other concentrates low in protein

Corn

Corn is the mainstay of pork production in the United States. Often corn is one of the cheapest grains for swine feeding in some parts of New York and especially in the Corn Belt States. Corn is palatable to swine of all ages but it is lacking in protein and minerals, the materials that are necessary for the building of bones, muscles, hair, and connective tissue. Corn is a satisfactory feed for swine when it is properly supplemented with other feeds that are rich in protein and minerals. It is low in calcium and contains only a fair amount of phosphorus. Yellow corn is high in vitamin-A value, while white corn is low in this respect. Pigs that are fed white corn and separator skim milk may die from pneumonia after having been fed this ration for several weeks, while pigs that get yellow corn instead of white will survive and make satisfactory gains. Corn may be fed on the ear or as shelled corn (page 54). Corn and cob meal is not a good feed for growing and fattening pigs.

Hominy Feed

Hominy feed is apt to be higher in fiber and higher in fat than is corn, and usually is considered to be worth about 95 per cent as much as corn for swine feeding. White hominy often costs more per ton than does yellow hominy, but this is illogical, because white hominy, like white corn, is low in vitamin-A value.

A low-fat hominy feed is preferable when used in rations for fattening pigs. Experiments conducted at the Purdue University Agricultural Experiment Station³ showed that hominy feed containing 7.4 and 8.1 per cent of fat produced a high percentage of undesirable pork. This hominy feed seemed to have a softening effect upon the fat. A test with low-fat hominy feed, containing 5 per cent of fat, showed that there was a good degree of firmness in the pork produced.

Barley

Barley is a common swine feed in the northern part of the United States, in Canada, and in Europe. Ground barley is worth about 95 per cent as much as corn. Since barley is richer than corn in protein, less protein-rich supplement is needed to balance a ration when barley is fed. Barley is a satisfactory substitute for corn in the average swine ration, even though it

³ The relation of hominy feed to the production of soft pork. By J. R. Wiley, C. M. Vestal, and C. L. Shrewsbury. *Am. Soc. An. Prod. Proc.* 1937: 115-121. 1937.

is handicapped because it is higher in fiber and must be ground or crushed for best results when fed to swine.

Wheat

Wheat usually is too high in price, unless it is not a first-grade product, to be used in swine feeding. It is richer in protein than is corn and is equal or slightly superior to corn in feeding value. Wheat should be coarsely ground or rolled when it is to be used as a swine feed. Even though wheat is somewhat richer than corn in protein it requires the addition of a supplement to produce rapid and satisfactory gains for pigs in dry lot.

Oats

Oats, if they do not make up more than one-third of the ration, are excellent for pigs or for the breeding herd. They are rather bulky in nature, high in fiber, and must be rolled or finely ground for best results. Oats are higher in protein content than is corn but only slightly higher in protein content than barley. The Illinois Agricultural Experiment Station reports⁴ that only when oats are as cheap as corn per pound will a ration that contains oats in any form produce as cheap gains as will a ration of corn and a protein supplement. Many breeders prefer to include some ground oats in the rations for the breeding herd or for growing gilts and boars. "Rolled" or hulled oats are excellent additions to rations for pigs under 50 pounds in weight.

Rye

Rye is sometimes used as a swine feed in sections where corn cannot be grown successfully. Rye is somewhat unpalatable to swine and should be coarsely ground or rolled before feeding. Best results may be obtained when rye is mixed with corn, wheat, barley, or other ground grains and is supplemented with suitable protein-rich concentrates. When fed in this manner to swine, ground rye is worth slightly less than ground barley. Rye that is contaminated with ergot may cause pregnant sows to abort.

Buckwheat

Buckwheat is rarely used as a swine feed and is less valuable for this purpose than is corn because of its high fiber content. Work carried on at a Canadian experiment station shows that buckwheat tends to produce a

⁴ Oats as a feed for swine. By W. E. Carroll. Univ. Illinois Agr. Exp. Sta. Cir. 414:1-12, 1933.

bacon of poor quality and may cause skin eruptions on pigs. Ground buckwheat should not make up more than 20 per cent (by weight) of the ration.

Garbage

Garbage varies greatly in composition, but, on the average and allowing for normal losses by death, a ton of city garbage may be expected to produce about 40 pounds of marketable live weight of hogs. Many of the larger pork producers in New York State depend largely upon garbage as the swine feed. Household garbage is usually not so good as that obtained from restaurants and public eating places. When garbage is collected frequently and is free from tin cans, soap, broken glass, and other undesirable or injurious foreign materials, it is a satisfactory swine feed. It is best not to force a sow nursing pigs to depend upon garbage alone. Garbage is so variable in quality that it is difficult to avoid scours in the little pigs when lactating sows are fed much garbage. Pigs less than 65 or 70 pounds in weight make more satisfactory growth if not forced to depend upon garbage as their sole source of food. Frozen garbage should be thawed before feeding.

The *value of sanitary measures* cannot be over estimated. All uneaten garbage should be cleaned up frequently. Feeding platforms should be kept clean and mud holes should be eliminated. It may pay well to move the feeding grounds to a new area and to plow the old feeding yards at least once a year.

Garbage is a well-balanced ration in itself and no supplementary feeds are needed. The feeding of alfalfa or clover hay in addition to garbage is recommended during the winter months. When the garbage supply is inadequate, a satisfactory concentrate mixture may be substituted. Pigs immunized against cholera seldom, if ever, contract the disease from eating garbage. Pigs that have not been immunized are apt to get hog cholera from eating raw pork scraps which frequently are found in garbage. There is little danger of the pigs getting hog cholera if the garbage is thoroughly cooked before it is fed. Offal from slaughterhouses should be cooked before it is fed.

There is a provision in the General Municipal Law of New York State, known as Section 135d, which was enacted in 1942 and is known as Chapter 214. It is as follows:

Any contract made or any permit issued by a municipal corporation or any public or private institution therein for the sale, collection or disposal of garbage shall require that the garbage be boiled for not less than one-half hour before it shall be used for the purpose of feeding pigs, hogs or swine.

A regulation concerning the feeding of garbage, known as Chapter 375, an Act to amend the Agricultural and Markets Law, in relation to the feeding of garbage to domestic animals, became effective on July 1, 1953. This regu-

lation requires that the garbage should be cooked and heated to a temperature at least 212° F. and must be maintained at this temperature for a period of not less than 30 minutes. This ruling was put into effect because feeding raw garbage to domestic animals contributes to the spread of vesicular exanthema, cholera, erysipelas, and other infectious animal diseases. Meat from afflicted animals when consumed by a human being is a primary source of trichinosis and other human sickness. Vesicular exanthema has been seen in New York State and the symptoms are similar to those found in foot-and-mouth disease. It is not necessary for any person to cook the garbage from his own household, only, if he feeds the garbage to domestic animals or poultry on his own premises.

Any person desiring to feed garbage to farm animals and poultry should make an application to the Commissioner of Agriculture in Albany, New York.

Concerning the quality of pork produced by garbage-fed hogs J. H. Zeller⁵ says:

The quality of meat produced by garbage-fed hogs is believed to vary considerably, being influenced by variations in conditions under which it is fed and the quality of garbage itself. So far as this Bureau has been able to ascertain, there is no experimental evidence showing that the meat of hogs raised to a satisfactory finish on a good quality of garbage is inferior to that of hogs that have received other feed. Some buyers, however, pay a lower price for garbage-fed hogs than for grain-fed hogs on the grounds that the former have a larger percentage of shrink.

To offset the market discount, feeders may find it profitable, when the price of grain is reasonable, to supplement the garbage diet with a grain ration for 6 to 8 weeks before marketing. This gives hogs thus fed the market status of grain-fed hogs, and they should bring approximately the same price. At times it may be profitable, following an all-garbage diet, to give the hogs a four-weeks finish on a standard grain ration, properly supplemented. The method of finishing the hogs prior to market will depend on local market conditions for both feed and hogs, and would have to be determined by the feeder himself.

Protein-rich supplements

Dairy by-products

Skimmilk and buttermilk contain about 9.5 per cent dry matter and 3.5 per cent protein and are ideal supplements to farm grains for growing and fattening pigs and also for the older hogs in the breeding herd. About 6 to 10 pounds of skimmilk or buttermilk per head daily is enough to balance the ration of pigs that are either self-fed or hand-fed on corn or hominy feed and do not have access to pasture. About 4 to 6 pounds per head daily is enough when the pigs have access to good pasture. Slightly smaller amounts of these dairy by-products are needed when pigs are fed barley, oats, or wheat in the place of corn. When fed in these proportions, 100

⁵ Animal Nutrition Division, mimeographed report 3. U. S. Dept. Agr. March, 1938.

pounds of skimmilk or buttermilk is equal in feeding value to 10.9 pounds of corn and 7.3 pounds of tankage.⁶ Thus when corn is worth \$1.68 a bushel and tankage or fishmeal 6 cents a pound, then 100 pounds of skimmilk or buttermilk would be worth about 75 cents when fed as directed. If an abundant supply of buttermilk and skimmilk is available on the farm, more than the amounts suggested may be fed. The feeding value of the amounts fed in excess to that needed to balance the ration will be worth slightly less.

Evaporated or condensed buttermilk usually contains about 65 per cent or slightly more of moisture and about 11 per cent of protein. This semi-solid product is a good feed for swine if the price is not too high. One-third as much condensed buttermilk is needed to supply about the same amount of nutrients as are furnished by ordinary liquid buttermilk or skimmilk. A mixture of about 3 pounds of condensed buttermilk and 7 pounds of water has about the same feeding value as fluid buttermilk.

Dried skimmilk or dried buttermilk are often too high in price to be used as pig feed. At times, however, slightly damaged lots of these dried dairy products are available at low prices. Dried skimmilk or dried buttermilk contains about 32 or 35 per cent protein, and 10 pounds of the dried product mixed with 90 pounds of water is equal in feeding value to 100 pounds of fluid skimmilk or buttermilk.

The extra labor involved in feeding milk products and the cost of transporting these feeds also should be considered when determining whether or not they should be fed.

Whey

Whey is relatively low in protein because the casein of the milk is removed in cheese-making. Whey is worth about one-half as much per 100 pounds as skimmilk or buttermilk. Morrison reports that excellent results have been obtained at the Wisconsin Agricultural Experiment Station⁷ by feeding a ration consisting of barley and whey to well-grown pigs weighing from 125 to 150 pounds. Other trials conducted at the same station have shown that for younger pigs some protein-rich feed, such as wheat feed or wheat middlings, should be added to the barley and whey to balance the ration more completely. The younger pigs are unable, because of the lack of feeding capacity, to consume enough whey to balance properly the barley that they have eaten.

Separator skimmilk, buttermilk, or whey is sometimes deficient in vitamin

⁶ Feeds and Feeding, pp. 591 and 592. By F. B. Morrison. (Twenty-first edition.) 1948.

⁷ Feeds and Feeding, pp. 591 and 592. By F. B. Morrison. (Twenty-first edition.) 1948.

A. Such a product when fed with white corn or with other feeds that have a low vitamin-A value will give poor results after it has been fed for some time. This trouble can be prevented by adding 5 to 10 per cent of alfalfa or clover hay to the ration, or by the use of yellow corn instead of white corn. The alfalfa or clover hay may be ground or chopped and mixed with the corn and other grain for the pigs or it may be placed in a rack where the older hogs will have free access to it. The addition of alfalfa hay is not necessary when swine have access to good pasture.

The inclusion of field-cured legume hay aids in the prevention of rickets in pigs fed in dry lot, especially when they get little exposure to sunshine. It pays to select hay of the best quality for pigs.

All of these dairy by-products should be pasteurized at the factory, to prevent the spread of disease, and should be fed under sanitary conditions. The cans or tubs in which the milk or milk by-products may be stored should be thoroughly cleaned at frequent intervals. Fresh milk is preferred for pigs under 10 weeks of age but these young pigs and the remainder of the herd will do well on sour-milk products. It is better to feed sour milk all of the time than to be changing frequently from sweet to sour.

Some persons hesitate to raise pigs because the supply of skimmilk or buttermilk will not be available during the entire growing and fattening period of the pigs. No doubt a number of farmers would find it profitable to feed these dairy by-products to the pigs as long as the supply lasts and then supplement the grain fed with such protein-rich concentrates as tankage, meat scraps, or fish meal and soybean oil meal when the supply of dairy by-products is no longer available.

Tankage and meat scraps

Tankage is high in protein, calcium, and phosphorus. The protein contained in tankage corrects the deficiencies of the proteins in the cereal grains. Tankage is equalled only by fish meal and skimmilk or buttermilk as a protein supplement in swine rations.

Two different processes are used in the manufacture of tankage, or meat meal. The method which has been employed for many years is known as the *digester method*. During recent years the dry-rendered method has come into use.

Digester tankage, or meat meal, usually contains 60 per cent of protein, but some grades contain only 50 or 55 per cent. It is made by thoroughly cooking for 6 or 8 hours under steam-pressure the fresh meat scrap, fat trimmings, and scrap bone. After this mass has been cooked, the fat is skimmed off, the soupy liquid is drained off, and the residue is pressed to remove as much fat and water as possible. After the soupy liquid has been

boiled down, it is added to the solid-meat residue. After this mixture has been thoroughly dried and any pieces of metal have been removed, it is ground or granulated and is ready for feeding. Dried blood is often added when a feed containing 60 per cent of protein is desired.

In the *dry-rendering method*, the raw material is cooked in an open steam-jacketed vessel. The mass is stirred during the drying process. After the moisture has been driven off and the fat has been drained off, the material is pressed to remove more of the fat. The dry residue then is ground to form *meat scraps*. Dry-rendered tankage is lighter in color and has less odor than *digester tankage*. Meat scraps that contain 50 to 55 per cent of protein, are about equal in feeding value to digester tankage which contains 60 per cent of protein.

Fish meal

The better grades of fish meal are rather similar in composition to those of the better grades of tankage. Much of the fish meal used for swine feeding is the by-product of oil extraction from the Menhaden herring, which is caught off the Atlantic Coast.

Experimental work has shown that high-grade fish meal is as good or even superior to tankage as a supplement to the cereal grains in swine feeding. Shelled corn and Menhaden fish meal provide one of the best rations that can be fed to growing and fattening pigs that have access to good pastures such as rape, alfalfa, or clover. When fish meal is fed to growing and fattening pigs in dry lot, it usually is fed in combination with soybean oil meal or linseed meal, ground or chopped alfalfa hay and corn, or other grain or mill feeds.

Standard wheat middlings or shorts

Standard wheat middlings or shorts are popular feeds for all classes of swine in the eastern part of this country. They are rich in phosphorus but very low in calcium. Shorts alone do not make an efficient supplement to the cereals for pigs in dry lot, probably because they do not contain the proper kind of protein. Pigs that do not have access to pastures make very much better gains if they are fed a small amount of tankage or fish meal or dairy by-products in addition to the grain and shorts. Middlings, or shorts, contain only about 17 per cent of crude protein, and consequently a great deal more of this feed is needed to balance the ration than of tankage or soybean oil meal or linseed meal. Middlings when used as the sole supplement seem to give better results for pigs on good pasture than for those in dry lot.

Flour wheat middlings

Flour wheat middlings contain less fiber, have a slightly higher protein content, and contain more total digestible nutrients than do standard middlings. Flour middlings are worth a little more than standard middlings for swine. Flour middlings and red dog flour are preferred for young pigs. Both of these feeds are palatable. Red dog flour does not differ a great deal from flour wheat middlings.

Wheat bran

Wheat bran is too bulky for growing and fattening pigs, but makes an excellent addition to a ration for the brood sows a few days before and after farrowing time. Some feeders like to include it in the brood-sow rations during the gestation period because it supplies bulk to the ration. A more economical and satisfactory way of supplying this bulk is to give the sow herd access to good pasture in the summertime or access to clover or alfalfa hay in a rack or mixed with the feed during the wintertime. Wheat bran is worth considerably less than standard wheat middlings as a feed for swine.

Linseed meal

Linseed meal is not satisfactory as the sole supplement for dry-lot-fed pigs but gives better results for pigs on pasture. It is an excellent protein supplement when fed with corn and tankage for pigs on pasture or when fed with corn, tankage, and ground alfalfa hay for pigs in dry lot. Linseed meal is low in calcium, is low in the same amino acids that are deficient in the cereal grains, and is not exceedingly palatable to swine. It should not be used as the only supplement to corn or other grains, as it does not make good the deficiencies in quality of protein in the grains.

Cottonseed meal

Cottonseed meal, if fed in large quantities, may be poisonous to swine. It can be fed satisfactorily to all classes of swine if not more than 9 per cent of the ration is cottonseed meal. It may be used in swine rations as a substitute for linseed meal.

Cull beans

Cull beans are a satisfactory feed for swine when they have been thoroughly cooked and are fed with some carbonaceous feed. Pigs make satisfactory and economical gains when fed equal parts of cooked cull beans and ground corn. Much better results are obtained if the cull beans are fed in

combination with corn, tankage, or fish meal, and alfalfa hay or pasture. Beans are more satisfactory for the older hogs than for young pigs. Salt should always be added to the water in which the cull beans are cooked at the rate of not more than $\frac{1}{2}$ pound of salt for each 100 pounds of dry beans. Minerals, especially calcium and phosphorus, are needed when rations consist chiefly of beans and grain and hay or pasture.

Soybeans

Soybeans supply protein of better quality than most feeds of plant origin, and also contain about as much protein as does linseed meal. Because the pork from hogs fed an appreciable amount of soybeans is soft, soybeans should not be fed in large amounts to growing and fattening pigs. Whole soybeans are satisfactory as a protein supplement for brood sows and boars, and for pigs that are being raised for breeding stock. Soybeans are low in calcium, and, therefore, ground limestone or bone meal is needed when soybeans are fed as the only supplement.

Investigators at the Purdue University Agricultural Experiment Station^{*} recommended that *no soybeans* be fed to pigs under 75 pounds in weight if these pigs are to have access to pasture. If the pigs are to be fed in dry lot, they should not receive soybeans until they reach a weight of 125 pounds. They state that soybeans should not be fed as a substitute for corn but, rather, they should be fed as a supplement to corn. They have found that 14 per cent should be considered the maximum quantity of soybeans to be used in rations for pigs that are being fed for market.

Soybean oil meal

Soybean oil meal that contains 41 or 44 per cent of crude protein is relished by hogs of all ages. Soybean oil meal is one of the best protein-rich concentrates of vegetable origin for pork production, and may serve as the sole substitute for protein concentrates of animal origin when these are not available. If the pigs which are fed soybean oil meal do not have access to good pasture, it is best to feed also some protein supplement of animal origin. A mineral supplement, limestone or bone meal, is needed when soybean oil meal is fed as the only supplement. Soybean oil meal may be used as a substitute for linseed or cottonseed meal.

A ration of corn, soybean oil meal, alfalfa (10 per cent of the mixture), and minerals gives fair results for growing and fattening pigs fed in dry lot.

^{*} The effect of soybeans, soybean oil meal, and tankage on the quality of pork. By C. M. Vestal and C. L. Shrewsbury. Purdue Univ. Agr. Exp. Sta. Bul. 400:1-47. (Reference on p. 2.) 1935.

The addition of trace amounts of cobalt, copper, iron, and manganese and of vitamin B₁₂ is recommended for better results (page 45).

Green forage crops

Pastures are the foundation of profitable pork production. They are so important that many times they determine the difference between profit and loss. Experiments carried on at many state experiment stations have shown that pastures reduce the cost of pork production, make healthier pigs, and keep up soil fertility.

Although many swine raisers provide pasture for their hogs, a few still keep their hogs quartered during the summer months either in small barren pens or in the barnyard. On many farms the pasture provided is on a steep, stony, bare hillside, or on a waste piece of land that cannot be cultivated profitably. Such situations are not a substitute for good pasture. A summary of many experiments shows that an acre of alfalfa or clover pastured by growing and fattening pigs should save from 1000 to 1100 pounds of corn and 450 pounds of tankage in comparison with dry-lot feeding. At the usual prices of feed, an acre of clover or alfalfa pastured by pigs should save the farmer more money than many such acres would earn when harvested as hay.

Alfalfa, clover, dwarf Essex rape, and broad-leaved rape are the best pig pastures for New York. Rape has the advantage over the legumes in that it may be planted in the early spring or midsummer at the rate of 7 to 10 pounds to the acre, and should be ready for use in eight or ten weeks after it is sown. A mixture of 1 bushel of oats and 6 to 8 pounds of rape, or of 1 bushel of oats, 1 bushel of field peas, and from 5 to 7 pounds of rape to the acre provides excellent pasture for swine.

Fall-sown wheat, or rye, or rye and vetch are good *early spring pig pastures*, and are highly recommended when other "clean" pastures are not available. The use of rye pasture, sown at the rate of 2 bushels per acre, makes it possible to get the sows and their nursing pigs on pasture two or three weeks before other forage crops are ready. An acre of such feed furnishes enough grazing for 10 to 12 sows and their suckling pigs. A good stand of clover and alfalfa in normal years provides a good early spring pig pasture under New York conditions. Other forage crops such as oats, oats and sweet clover, oats and rape, soybeans, soybeans and corn, are excellent pastures for swine when they can be grown successfully.

An acre of good alfalfa, clover, or rape should furnish enough pasture for about 18 to 20 pigs from the time these pastures are ready to be grazed until freezing weather in the fall of the year. An acre of good pasture is enough for 5 to 8 open or bred sows or gilts. Pasture is of more value for

young pigs than for pigs over 150 pounds in weight. Some feeders prefer to bring the fattening hogs into the barn or dry lot after they reach an average live weight of from 100 to 150 pounds.

Hogging-off corn

Hogging-off corn saves some of the labor required for harvesting. This is an effective method if the corn is down or badly lodged. Much of the grain, however, is trampled into the soil and is lost if hogging-off is done during wet weather. It is essential that the hogs be fed about $\frac{1}{3}$ to $\frac{1}{2}$ pound daily of a suitable protein supplement and be given access to fresh water at all times when hogging-off corn. They should be provided with suitable shelters and comfortable beds. Temporary fences may be used to enclose areas that will provide only enough feed for about 30 days at a time. If larger areas are provided, the hogs are apt to waste grain. Pigs more than 100 pounds in weight are best for hogging-off corn. Hogging-off corn is not a popular practice in New York and is used less in the corn belt than it was a few years ago.

Hay

The use of legume hay for swine has already been suggested (pages 25, 29, and 30). Legume hay of good quality, cured in the field, is rich in both vitamin A and vitamin D. Artificially dried or dehydrated hay is rich in vitamin A, but has little or no vitamin D. All legume hay is rich in protein and calcium and it contains the kind of protein that efficiently supplements the cereal grains. It differs a great deal in these respects from the proteins of linseed meal or wheat middlings.

The breeding herd should have access to legume hay when pasture is not available. A simple method of supplying legume hay to the sow herd is to feed it in a slatted rack. Alfalfa hay is one of the best legumes that can be used for this purpose because it is leafy and, when well cured, is reasonably palatable to swine. A number of experiments have shown that it pays to mix 5 to 10 per cent of ground or chopped alfalfa hay in the rations fed to growing and fattening pigs. Finely-ground hay should be used in rations for the pigs under 100 pounds in weight and somewhat more coarsely ground hay is satisfactory for the heavier hogs. Hogs more than 100 pounds in weight may eat enough hay if it is of good quality and is supplied in a rack, but it is necessary to mix ground hay with feeds for lighter pigs. The leaves and chaff from alfalfa hay which fall on the barn floor may be used as a substitute for the ground or chopped hay, especially when grinding or chopping facilities are not available. Clover hay is much less palatable to swine than is alfalfa, and furthermore is not so rich in protein or in calcium. Even



Figure 14. A mud-hole like this one is not an asset to the farmer or to the hogs that wallow in it.

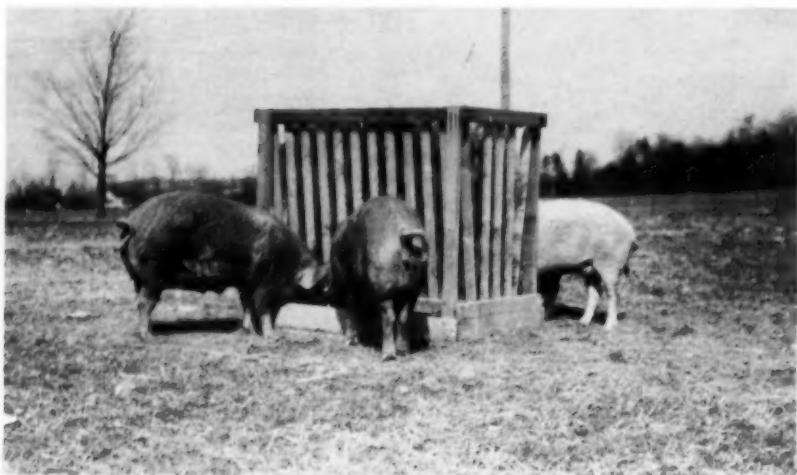


Figure 15. This is one of the easiest and best ways to feed legume hay to sows in winter or in dry lot.

though it is inferior to alfalfa hay as a swine feed, it should be fed as a substitute when alfalfa is not available. When neither alfalfa nor clover hays are available, then sweet-clover hay or soybean hay may be used as substitutes. Usually the young pigs and sometimes the sows will not eat enough of these hays when they are supplied in a rack. Then it would be best to chop or grind it and mix it with the concentrate mixture.

Roots and other succulent feeds

Potatoes

Potatoes are one of the most important succulent feeds for swine in normal times. Marketable potatoes are worth too much to be used for swine feed, but cull potatoes can be used economically in the swine ration. Potatoes furnish much less protein than does corn and for this reason a generous amount of an efficient protein supplement must be added to a ration containing them. Potatoes should be cooked and fed along with other concentrates. It is reported⁹ that 410 pounds of potatoes weighed before they have been cooked are equal to 100 pounds of corn or barley in feeding value. For best results the proportion of potatoes should be not more than 4 pounds of potatoes to 1 pound of concentrates. Raw potatoes are not a good feed for swine.

Roots are seldom fed to swine in this section of the country. It is reported¹⁰ that 448 pounds of roots are equal to 100 pounds of concentrates. When roots are fed, they usually are added to a ration that already is balanced and adequate for swine. Some breeders consider roots a desirable addition to the brood-sow ration because they are palatable, succulent, and laxative. Roots, on the other hand, are low in protein and in lime. Alfalfa or clover hay is a much more desirable supplement to brood-sow rations than are roots because hay contains protein of good quality, calcium, and fat-soluble vitamins, and at the same time is laxative in nature.

Soilage crops

Soilage crops may be cut and fed to swine if it is not possible to provide pasture. Because the pigs may waste much of the silage crop fed in this manner, it is more satisfactory and economical to fence off an area on which the green crop is growing and to allow the pigs to do their own harvesting. Electric fences are less costly than woven-wire fences and are satisfactory when used to enclose temporary pastures especially when the pigs are full fed.

⁹ Feeds and Feeding, pp. 448-449. By F. B. Morrison. (Twenty-first edition.) 1948.

¹⁰ Feeds and Feeding, p. 447. By F. B. Morrison. (Twenty-first edition.) 1948.

Minerals

It is doubtful whether a mineral supplement is needed in a swine ration if the ration contains enough protein supplements of animal origin (tankage, meat scraps, fish meal, dairy by-products, and the like) and, also, if the swine are on pasture or if the ration contains liberal amounts of legume hay. Pigs need less salt than do the other farm animals, but they should have it regularly. *Common salt* may be supplied in a box or a small self-feeder. If the pigs have not had free access to salt, they may overeat at first if allowed free access to it. Therefore, it is best to place only a small quantity of salt in the box or self-feeder at first and to gradually increase the amount until salt is kept before them at all times. If the pigs do not have access to salt or to a mineral mixture containing salt, then $\frac{1}{2}$ pound of salt should be mixed with each 100 pounds of the ration fed. *Iodized salt* should be fed to pregnant sows and gilts.

Although the ration seems adequate in every respect, it may be wise to feed a simple mineral mixture. These mixtures are inexpensive and may be beneficial. The use of homemade mineral mixtures is highly recommended when the rations are supplemented chiefly with protein concentrates of plant origin such as linseed meal, soybeans, or soybean oil meal. Even though only a part of it is utilized by the hog, the remainder is not wasted for it eventually is returned to the land in the form of fertilizer. A simple mixture consisting of 40 pounds of finely ground limestone, 40 pounds of



Figure 16. A box, made of hard wood and built like this one, is useful for feeding minerals or salt.

ground steamed bone meal (feeding grade), and 20 pounds of salt, or 50 pounds finely ground limestone, 30 pounds dicalcium phosphate (feeding grade), and 20 pounds salt, or a mixture of 70 pounds ground limestone and 30 pounds of salt seems to give satisfactory results. One of these mixtures may be kept in a hard-wood box in a sheltered place where the pigs may have access to it. When liberal amounts of meat scraps or fish meal are fed, usually there is no need to mix mineral mixtures with the feed. In this case, salt alone is enough.

In sections of the country where farmers have experienced losses from hairless pigs, it is wise to supply some iodine in the ration of the pregnant sow and gilt. This can be supplied by dissolving 1 ounce of potassium iodide or sodium iodide in a gallon of water and then feeding the sow 1 tablespoonful of this solution daily during the gestation period. A more simple method of supplying iodine would be through the use of *iodized salt* in the mineral mixture or in the feed mixture. The author has learned of a few cases of "hairlessness" or goiter in new-born pigs in this State.

There is no need for the inclusion of charcoal or soft coal in rations for swine.

Trace minerals

Research work at Cornell University¹¹ with growing and fattening pigs fed in dry lot, showed that the addition of small amounts of cobalt, copper, iron, and manganese to a ration of plant origin, significantly increased the rate of gain. The pigs fed these trace minerals required slightly less feed for 100 pounds of gain.

The trace minerals were fed by mixing them with iodized salt so one-half pound of the mineralized salt in each 100 pounds of feed furnished 0.9 ppm¹² of cobalt, 0.9 ppm of copper, 8.8 ppm of iron, and from 66 to 88 ppm of manganese. The basal ration of plant origin to which these trace minerals were added was composed of ground yellow corn, soybean oil meal, 10 per cent of ground field-cured alfalfa hay, iodized salt, calcium, and phosphorus.

It is recommended that 100 pounds of the trace-mineral-salt mixture contain trace elements at the rate of 8 grams of cobalt, 8 grams of copper, 80 grams of iron, and 600 grams of manganese. It is possible to buy commercial salt mixtures containing these trace minerals at a slightly greater cost than iodized salt.

¹¹ *Farm Research*, 17: 14-15. January 1951.

¹² ppm = parts per million.

Vitamins

Most swine rations which are fed to pigs that have access to good pasture seem to contain all of the necessary vitamins. Pigs that are kept indoors for a long period of time and are not fed field-cured alfalfa hay and do not have access to direct sunlight may develop a disease which is due to a deficiency of vitamin D. A deficiency of this vitamin in the diet shows itself by such symptoms as stiffness and lameness. This condition is commonly known as *rickets*. Access to the out of doors, where the pigs are in the sunshine, and access to alfalfa hay or to pasture, usually will prevent and sometimes cure this condition. The use of cod-liver oil is advised in severe cases. Doses of cod-liver oil ranging from a tablespoonful for a 75-pound pig to an ounce for a 200-pound pig usually will correct this condition. Some pigs will show great improvement after having been given a daily dose of cod-liver oil for only a few days, while other pigs will need more treatment before they show any considerable improvement. Other fish oils and irradiated yeast are sources of Vitamin D.

A deficiency of vitamin A usually manifests itself by such symptoms as failure to grow, watering of the eyes, unthrifty appearance, wobbly gait, and perhaps pneumonia. This condition is apt to develop when the pigs do not have access to pasture and are fed a ration consisting of white-hominy feed, white corn, separator skim milk, or other feed containing no source of vitamin A. It can be prevented by feeding yellow corn, and by giving pigs access to good pasture or by including in the ration about 5 to 10 per cent of good-quality alfalfa hay. When little or no protein of animal origin such as tankage, meat scraps, or milk products is used, it is recommended that 10 per cent of alfalfa or clover hay be included in the ration.

In addition to being a good source of protein, calcium, and vitamin A, alfalfa hay supplies liberal amounts of the necessary B vitamins. When little or no legume hay is used, it may be necessary to supplement the ration with other sources of the B vitamins, especially riboflavin, niacin, and pantothenic acid. Feed dealers may be able to supply these vitamin supplements.

Vitamin B₁₂ and Antibiotics

The discovery of vitamin B₁₂ was not announced until April 1948, but much research has been conducted recently to study the value of vitamin B₁₂, when added to rations for pigs. Most of the experiments reported have been conducted with pigs fed on concrete, without access to pasture or even to dirt, and with brood sows that were housed continuously for long periods of time.

Other experiments have been conducted with pigs on pasture or fed good

rations in dry lot containing alfalfa and animal protein. In these cases little or no benefit resulted from vitamin B₁₂ supplementation.

There have been some striking benefits from adding such supplements to a ration that contained no meat scraps, tankage, fish meal, or dairy by-products for pigs fed in dry lot.

Numerous experiment station workers continue to carry on studies to determine the value of antibiotics. Aureomycin, streptomycin, penicillin, bacitracin, and terramycin, have been used in these studies. Certain of these antibiotics have shown promise of being worthwhile additions to growing and fattening rations for pigs not on pasture.

This is particularly true for pigs up to weights of 100 to 125 pounds and for pigs raised in dry lot. Antibiotics are generally credited with controlling low-level non-specific infections (filth-borne) found in many hog lots. To date little or no benefit has resulted from feeding antibiotics to the breeding herd.

Commercial pig and hog feeds and protein supplemental mixtures containing vitamin B₁₂ and antibiotic supplements are now on the market. The manufacturers of these feeds keep in touch with the results of the latest research and include in their feed the needed amounts of vitamin B₁₂ and antibiotics.

Rapid progress has been made recently in the field of swine nutrition, but swine feeders should continue to follow a good system of swine sanitation and should employ good feeding and management practices. The use of good "clean" pasture for the breeding herd and for pigs, until they weigh from 100 to 125 pounds, is strongly recommended. The feeding of liberal amounts of ground alfalfa or clover hay in winter especially for the breeding herd cannot be over-emphasized. More information is needed to determine whether it will be profitable under good systems of care, feeding, and management, to include vitamin B₁₂ and antibiotics in the rations, especially when maximum use is made of good pasture or legume hay.

RATIONS FOR SWINE

Many farmers who feed only a few head of hogs may find it more convenient and economical to buy ready-mixed complete pig or hog feeds from the feed dealer than to mix them at home. These feeds may be fed straight or mixed with home-grown grain. Others may prefer to mix their own feeds. Concentrate mixtures are given on pages 48 to 50. These rations may be self-fed or hand-fed to growing and fattening pigs or hand-fed to the hogs of breeding age. Various combinations are suggested for pigs of different ages and weights.

The feeding of a herd of swine may be compared to the driving of an

Table 2. Ground Corn, Wheat Middlings, and Supplements

Ingredients	For pigs up to 75 pounds*		For pigs from 75 to 125 pounds* and for sows nursing pigs		For pigs more than 125 pounds and for open and bred sows and gilts†	
	In dry lot	On pasture	In dry lot	On pasture	In dry lot	On pasture
	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Ground corn	63.0	72.5	64.5	73.0	65.0	74.0
Meat scraps (50 per cent protein)	11.0	8.5	7.5	5.0	4.0	2.0
Soybean oil meal (44 per cent protein)	10.5	8.5	7.5	6.0	5.0	2.5
Wheat middlings	10.0	10.0	15.0	15.0	20.0	20.0
Ground alfalfa hay†	5.0	—	5.0	—	5.0	—
Ground limestone	—	—	—	0.5	0.5	1.0
Salt or iodized salt	0.5	0.5	0.5	0.5	0.5	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
Approximate percentage of:	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Protein	18.0	16.0	16.0	14.0	14.0	12.0
Calcium	1.07	0.78	0.76	0.65	0.63	0.55
Phosphorus	0.81	0.70	0.69	0.59	0.57	0.48

* Antibiotic and B₁₂ supplement (page 46).

† From 10 to 20 per cent of ground alfalfa may be included in* rations for bred sows and gilts fed in dry lot. If the grain is not too liberally fed, the alfalfa hay may be supplied in a suitable hay rack.

automobile. The driver may run his automobile into low gear and drive almost anywhere he pleases, but experience has taught him that he will get more efficient and satisfactory performance from his car if he shifts into second when the hills are not so steep and better still if he shifts into high gear whenever he possibly can. The pork producer may feed all of his swine just one ration. This ration might contain more protein than is necessary for the sow herd but not enough protein for the small pigs. To get the most satisfactory and efficient production from any swine herd, it usually pays to feed rations that are suited to the needs of the particular hogs being fed. For this reason several rations are suggested.

Ground oats may be substituted for some of the barley, wheat, or corn in the following rations, especially for fattening pigs that weigh more than 100 pounds and for brood sows and gilts in the breeding herd. Oats should not make up more than one-third of the ration for the fattening pigs, but greater amounts may be used for the breeding herd. On many farms, es-

Table 3. Ground Corn and Supplements

Ingredients	For pigs up to 75 pounds*		For pigs from 75 to 125 pounds* and for sows nursing pigs		For pigs more than 125 pounds and for open and bred sows and gilts†	
	In dry lot	On pasture	In dry lot	On pasture	In dry lot	On pasture
	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
Ground corn	71.0	80.0	76.0	85.5	80.5	89.5
Meat scraps (50 per cent protein)	12.0	9.5	9.0	7.0	6.5	4.5
Soybean oil meal (44 per cent protein)	11.5	10.0	9.5	7.0	7.0	4.5
Ground alfalfa hay†	5.0	—	5.0	—	5.0	—
Ground limestone	—	—	—	—	0.5	1.0
Salt or iodized salt	0.5	0.5	0.5	0.5	0.5	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
Approximate percentage of:	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Protein	18.0	16.0	16.0	14.0	14.0	12.0
Calcium	1.15	0.86	0.89	0.64	0.84	0.76
Phosphorus	0.78	0.68	0.66	0.57	0.55	0.46

* Antibiotic and B₁₂ supplement (page 46).

† From 10 to 20 per cent of ground alfalfa may be included in rations for bred sows and gilts fed in dry lot. If the grain is not too liberally fed, the alfalfa hay may be supplied in a suitable hay rack.

pecially where the supply of oats is limited, it may be best to feed the oats to the horses, sheep, or cattle and to buy corn or barley for the swine.

Soybean oil meal or cottonseed meal may be substituted for the linseed meal. These feeds have already been discussed on pages 38 and 39.

When protein concentrates of animal origin, such as tankage, meat scraps, and fishmeal, are plentiful, it is desirable to use about equal weights of the protein concentrates of plant and animal origin. If meat scraps containing 55 per cent protein are not available, then an equivalent amount of protein may be supplied in the form of 50 per cent protein meat scraps or 60 per cent tankage. It is necessary to use 1½ pounds of soybean oil meal to supply the protein furnished by 1 pound of digester tankage.

Protein supplemental mixtures

When supplies of protein concentrates of animal origin are available, one of the most satisfactory ways to feed growing and fattening pigs in dry lot

Table 4. Ground Barley or Wheat and Supplements

Ingredients	For pigs up to 75 pounds*		For pigs from 75 to 125 pounds* and for sows nursing pigs		For pigs more than 125 pounds and for open and bred sows and gilts†	
	In dry lot	On pasture	In dry lot	On pasture	In dry lot	On pasture
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Ground barley or wheat	78.5	88.0	83.5	93.0	88.5	95.5
Meat scraps (50 per cent protein)	8.0	5.0	5.0	2.5	2.5	—
Soybean oil meal (44 per cent protein)	8.0	6.0	5.5	3.0	2.5	2.0
Ground alfalfa hay†	5.0	—	5.0	—	5.0	—
Ground limestone	—	0.5	0.5	1.0	1.0	1.5
Di-Calcium phosphate	—	—	—	—	—	0.5
Salt or iodized salt	0.5	0.5	0.5	0.5	0.5	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0
Approximate percentage of:	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Protein	18.0	16.0	16.0	14.0	14.0	13.0
Calcium	0.82	0.66	0.73	0.61	0.68	0.69
Phosphorus	0.72	0.61	0.60	0.50	0.49	0.49

* Antibiotic and B₁₂ supplement (page 46)

† From 10 to 20 per cent of ground alfalfa may be included in rations for bred sows and gilts fed in dry lot. If the grain is not too liberally fed, the alfalfa hay may be supplied in a suitable hay rack.

is to furnish shelled corn, or ground corn, in one compartment and a mixture (by weight) of 50 per cent of tankage, meat scraps, or fish meal, 25 per cent of soybean oil meal or linseed meal, and 25 per cent of ground or chopped alfalfa hay in the other compartment of a self-feeder.

Also, under normal conditions, one of the best ways to feed growing and fattening pigs on *good pasture* is to supply shelled corn or ground corn in one compartment and a mixture (by weight) of 50 per cent of tankage, meat scraps, or fish meal and 50 per cent of linseed meal or soybean oil meal in the other compartment of a self-feeder. The pigs do an excellent job of balancing their ration when these feeds are fed in this manner. When ground barley, oats, and rye are fed, they should be mixed with the other grain or with the supplements. Swine that have access to *poor pasture* should be given rations similar to those fed to swine kept in the dry lot. Part of the hay should be omitted under these conditions.

Mixtures of protein supplements to be fed with grain

Supplement	Amount	Ingredients	Approximate protein content
		For swine fed in dry lot or on poor pasture	<i>Per cent</i>
1	40 pounds	Meat scraps, fish meal, or tankage	
	38 pounds	Linseed meal or soybean oil meal	
	20 pounds	Ground alfalfa or clover hay of good quality	
	2 pounds	Iodized salt	
	100 pounds	Total	37
2	30 pounds	Meat scraps, tankage, or fish meal	
	40 pounds	Soybean oil meal	
	26 pounds	Ground alfalfa	
	2 pounds	Ground limestone	
	2 pounds	Iodized salt	
	100 pounds	Total	38
3	20 pounds	Meat scraps or tankage	
	20 pounds	Fish meal	
	38 pounds	Soybean oil meal	
	20 pounds	Alfalfa meal	
	2 pounds	Iodized salt	
	100 pounds	Total	41
		For swine fed on good pasture*	
4	100 pounds	Tankage or meat scraps, or Menhaden fish meal	50 to 60
5	50 pounds	Tankage, or meat scraps, or fish meal	
	50 pounds	Soybean oil meal or linseed meal	
	100 pounds	Total	48
6	40 pounds	Meat scraps, or fish meal, or tankage	
	30 pounds	Soybean oil meal	
	30 pounds	Linseed meal	
	100 pounds	Total	43
7	20 pounds	Tankage or meat scraps	
	20 pounds	Fish meal	
	40 pounds	Soybean oil meal	
	20 pounds	Linseed oil meal	
	100 pounds	Total	44

* Two pounds of salt should be added to each of the supplements suggested for pigs fed on pasture or salt may be self fed.

Pork producers and breeders may prefer to buy protein supplemental mixtures that are on the market. These mixtures may contain various vitamin and mineral supplements and also antibiotics. The high-protein supplemental mixtures may be mixed with ground grain or mill feeds that the producer wishes to use or they may be fed free-choice in one compartment of a self-feeder with shelled corn in the other.

The mixtures of protein supplements (page 51) may be self-fed along with corn or hominy, or may be mixed with the ground grains or mill feeds to give final rations that contain from 12 to 18 per cent of total protein. Thus, 400 pounds of ground corn mixed with 100 pounds of supplement No. 1 yields a ration containing 14 per cent of total protein. This ration should be suitable for pigs more than 125 pounds live weight if they are fed in dry lot or for pigs, from 75 to 125 pounds, fed on good pasture.

It is easy to calculate the amounts of hog supplements needed to mix with grain and mill feeds to provide suitable rations for the various classes of swine. The content of protein needed for swine of the various classes and ages is shown in tables 2, 3, and 4.

Table 5. Approximate* Protein, Calcium, and Phosphorus Content of a Few Feeds

Kind of feed	Protein	Calcium	Phosphorus
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Corn	8.7	0.02	0.27
Barley	12.7	0.06	0.37
Oats	12.0	0.09	0.34
Rye	12.6	0.10	0.33
Wheat	13.2	0.04	0.39
Standard wheat middlings†	17.4	0.08	0.94
Wheat flour middlings	18.3	0.09	0.71
Digester tankage	60.0	6.37	3.23
Fish meal (Menhaden)	62.2	5.30	3.38
Meat scraps	55.8	8.33	4.04
Linseed meal (old process)‡	32.4	0.36	0.90
Soybean oil meal	44.0	0.30	0.66
Alfalfa (good quality)	15.0	1.47	0.24
Dicalcium phosphate		23.5	18.7
Ground steamed bone meal	7.1	32.6	15.2
Ground limestone		35.0	

*The analyses were obtained from *Feeds and Feeding* by F. B. Morrison, (Twenty-first edition 1948), or from analyses obtained on feeds used in feeding trials at Cornell University. There is considerable variation, especially in the protein content of various feeds. For instance, the protein content of No. 2 yellow corn used in feeding trials has ranged from 7.77 to 10.09. It is suggested that the guaranteed protein content of such feeds as middlings, linseed meal, meat scraps, fish meal, and the like, be used when this information is available.

†From *Feeds and Feeding* (Twentieth edition, 1936).

‡Use the guaranteed protein content of linseed meal, solvent process.

The rations should contain at least 0.40 per cent of calcium and at least 0.30 per cent of phosphorus. It is believed that better results are obtained, however, when the rations contain from 0.60 to 0.80 per cent of calcium and from 0.40 to 0.50 per cent of phosphorus. The use of excessive amounts of minerals may have an adverse effect upon the rate and economy of gain. Rations containing liberal amounts of meat scraps or other protein supplements of animal origin may furnish more calcium and phosphorus than is needed, but these rations usually give excellent results.

The information given in table 5 may be helpful to the feeder who wishes to mix his own rations either with or without the use of protein supplemental mixtures.

SELF-FEEDERS FOR SWINE

Much has been written and said about the use of self-feeders for swine. Experience has shown, however, that self-fed pigs usually make more rapid and economical gains than do hand-fed pigs. The use of self-feeders also saves labor; promotes sanitation; provides large feed-storage space; and the pigs usually seem happier and more contented. On the other hand, self-feeders are expensive, are often neglected, or may limit maximum use of forage crops. The troughs of self-feeders should be carefully cleaned occasionally.

Self-feeders may be used for growing and fattening pigs from the time they first eat grain until they reach the usual market weights. Gilts or boars



Figure 17. Self-feeders like this one may be used in dry lot or on pasture.

that are to be saved for breeding purposes may be self-fed until they weigh about 150 pounds.

Self-feeders with a total of 4 feet of feeding space are large enough for 2 or 3 sows and their nursing pigs or for about 15 growing and fattening shotes. Self-feeders with a total trough length of 10 to 12 feet are enough for about 40 to 50 pigs. If feeders with more than 4 or 5 feet of trough space are needed, it may be best to use the type with troughs on both sides. The feeders should be placed on wooden platforms when they are used on pasture, and near the water supply.

PREPARATION OF FEEDS

The preparation of feed is justified when the increased rate and economy of gains will pay for the cost of preparing it. Experiments have shown that it is not necessary to grind corn for pigs that are less than 150 pounds in weight. Pigs under this weight can use shelled corn to good advantage. Ground corn and cob meal is of less value than shelled or ground corn.

With such grains as wheat, barley, and oats, more of the grain passes through the animal undigested, and therefore grinding and crushing pays even though the pigs are less than 150 pounds in weight. Morrison¹³ reports that if small grains cannot be conveniently ground, they should be soaked for about 12 hours before feeding but should not be allowed to ferment.

It is not necessary to grind or chop leafy alfalfa hay for the sow herd when it can be provided in open hay racks where they will have access to it at all times. Occasionally, however, especially in very cold weather, the sows may not eat so much hay as they should when it is supplied in a rack. For these sows, additional hay should be chopped finely or ground and included in the concentrate mixture. It usually pays to finely grind the hay that is to be fed to growing and fattening pigs.

It pays to cook potatoes, soybeans, and cull field beans for swine. The results of many trials show that cooking feed (corn, barley, rye, and peas) for swine *decreases* its value.

FURTHER SUGGESTIONS

Castration

Pigs should be castrated when they are from one to six weeks of age, while they are still suckling their dams. At this time, the pig is small in size and can be easily handled. If the pigs are housed in clean barns or

¹³ Feeds and Feeding, p. 974. By F. B. Morrison. (Twenty-first edition.) 1948.

have access to clean pasture, if they are castrated with clean hands and clean instruments, and if the incisions are made low enough to insure good drainage, there will be little danger from infection.

Boars that are no longer useful in a herd usually are castrated and then are fattened before they are sold to slaughterers. They should not be offered for sale before the wounds from the operation have completely healed. The wounds usually heal in about six weeks.

Ringling

Every swine grower knows that a healthy hog likes to root in the soil. This habit may annoy the owner because the hogs are apt to dig holes under fences as well as to ruin a great deal of good pasture. Rooting can be prevented by placing a small ring or two in the snout. This can be done most easily when the pigs are small. One man can hold the pig while another inserts the ring. Older or larger hogs can be snubbed to a post with the use of a small rope around the snout. Hogs fastened in this manner usually throw most of their weight onto the rope and thus make it quite easy for a person to insert the hog rings. Usually, various sizes and types of hog rings are available on the market.

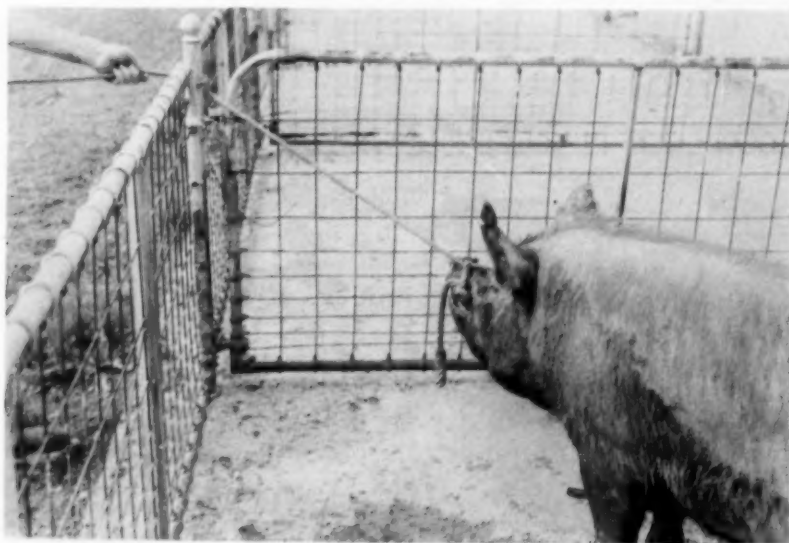


Figure 18. This is a good way to hold a sow to put rings in her snout, to trim a foot, or to take a blood sample.

Water supply

The amount of water consumed by the pigs depends upon the size of the pig as well as upon weather conditions and the type of ration fed. It is best to keep a supply of clean, fresh water before swine of all ages at all times. It is best to have the water supply near the feed supply if dry feed is fed. Either manufactured or homemade automatic waterers may be used. When automatic waterers are not available, water may be provided in troughs. During very cold weather it may be wise to take the chill from the water, so the pigs may drink as much as they should. Water consumption can be increased in cold weather by mixing it with the concentrates to form a slop. Pigs that are fed considerable quantities of dairy by-products require less water than pigs that are given only dry feed.

HERD RECORDS

Records are essential for the proper management of any herd of hogs. The breeder of purebred hogs is interested in a record of the breeding date, the boar used, the farrowing date, the number and sex of pigs farrowed, and the number and sex of pigs raised. The owner of the grade herd should be interested also in a record of the breeding date, the boar used, the farrowing date, the number of pigs farrowed, and the number of pigs raised. The purebred breeder needs much of this information so that he will be able to



Figure 19. This waterer is made with a barrel and a hog waterer attachment. Waterers should be placed on wooden platforms.

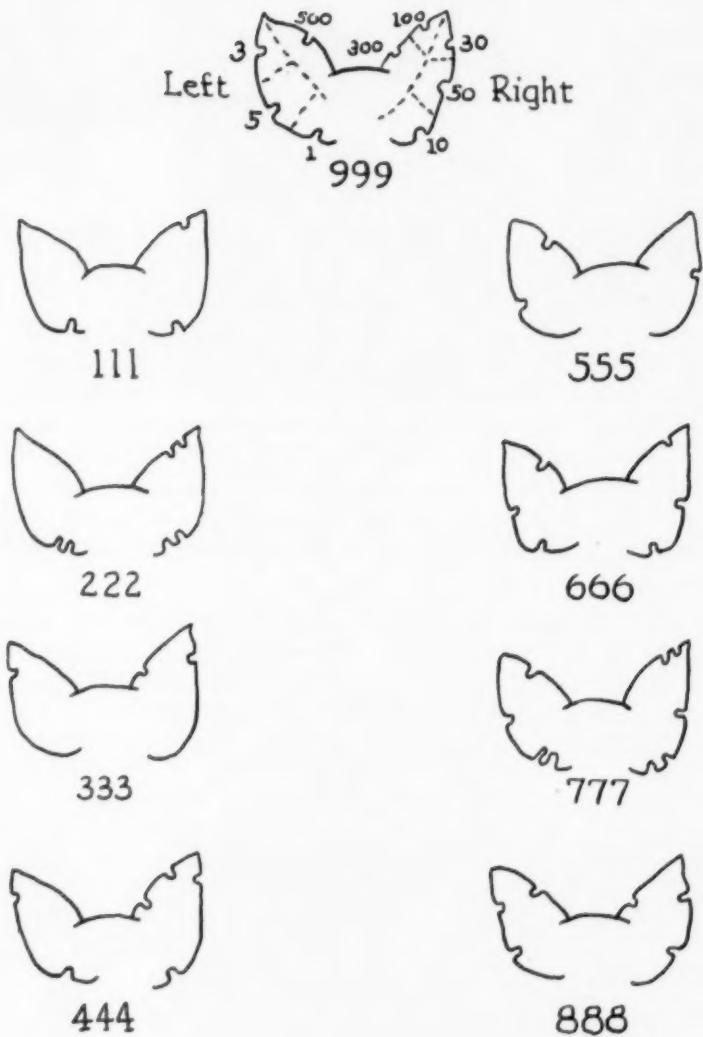


Figure 20. When this or a similar ear-notching system is used, the breeder is able to keep satisfactory records of his herd. A copy of the system in use should be posted in the record book or books. When this is done, even one unfamiliar with the herd is able to identify all the hogs in it. Some breed associations have ear-notching systems that the breeder may use.

register pigs of his own breeding, but both the purebred and the grade breeder need these records to carry on intelligent breeding operations. These records will aid them in selecting pigs for replacement in the herd and at the same time will be an invaluable aid in culling the sows that are not productive. It would be difficult, if not almost impossible, however, to keep accurate records without some system of identification. The ear-notching system is one of the easiest and most satisfactory methods of identifying pigs.

Ear-notching

It is easy to ear-notch pigs when they are small, but it may also be done when they are mature. One of the simplest ways to ear-notch is to give all pigs in one litter the same number. A number of breeders prefer, however, to give an individual number to each pig in the litter. If all of the pigs in one litter are given the same number, then the first litter born, for example, could be given the number 10, the second litter 20, and so on. When a pig is sold for breeding purposes or is retained in the herd, it maybe wise to further identify him. This can be done by changing the 10 to an 11, 12, 13, and so on by adding more notches in the ears. A suggested ear-notching system is shown in figure 20.

Pigs are most easily notched with a regular pig-ear-notcher which is constructed to cut a V-shaped mark in the ear (figure 21). If one of these pig-ear notchers is not available, then it may be done, especially on small pigs, with sharp scissors. Certain types of ear punches, such as are used for cattle, sometimes may be found useful for ear-notching pigs.



Figure 21. The smaller tool is best suited for notching the ears of small pigs, but the larger tool may be used with success on swine of all ages.

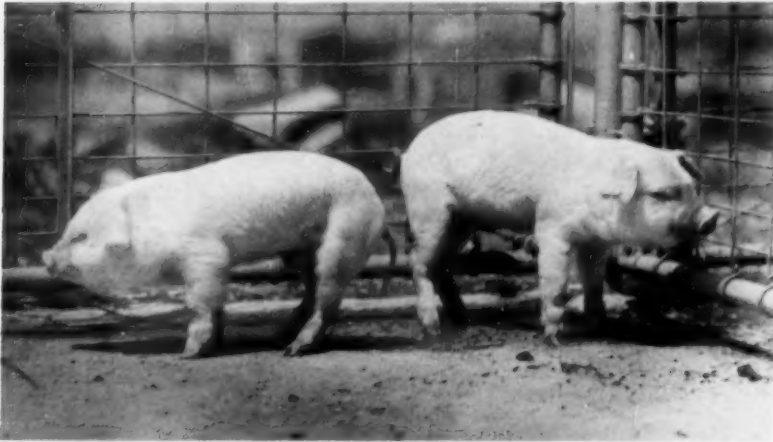


Figure 22. The pigs are the same age. The anemic pig on the left is soft and flabby in appearance, is thin, is emaciated, and has a heavy jaw and crooked hind legs.

SOME COMMON DISEASES AND AILMENTS OF SWINE

Anemia

Anemia in suckling pigs is due to a deficiency of iron in the ration of the pigs. At first the young pig has a small store of iron in his tissues, but the sow's milk is extremely low in this mineral, and it seems impossible to increase the iron content of the milk by feeding iron compounds to the sow. Therefore, unless the suckling pig can get iron from other sources, he will not obtain enough iron for the formation of the hemoglobin (or red coloring matter) in his blood, and anemia will result. The suckling pig, when he is on pasture, usually obtains enough iron from the soil and vegetation. New York swine breeders who breed their sows to farrow early in the spring or late in the fall are forced, because of weather conditions, to confine their sows and litters indoors on concrete or wooden floors. Under these conditions, the pigs may become so anemic at two to four weeks of age that they may die before weaning time.

Normal pigs when they are about two to four weeks of age are vigorous, active, plump, firm-fleshed, and have sleek coats. Anemic pigs, on the other hand, are listless, lacking in vigor, and are soft and flabby in appearance. Their skin becomes wrinkled and their coats have an unhealthy appearance. As the disease progresses their skin and mucous membranes become pale, they appear thin and emaciated, their legs get weak and

crooked, and may develop a chronic diarrhea. Anemic pigs seem to object more to being handled than normal pigs and even their squeal lacks the clearness of that of a normal pig.

The Wisconsin,¹⁴ Illinois,¹⁵ Indiana,¹⁶ and Cornell¹⁷ agricultural experiment stations have conducted numerous experiments to determine ways to prevent anemia in suckling pigs. Anemia may be prevented by swabbing the udder of the sow or by drenching the pigs with a saturated iron solution. This solution may be prepared by dissolving as completely as possible 1 pound of dried ferrous sulfate, or else an ordinary grade of copperas, in from 1 to 2 quarts of hot water. Swabbing the udder of the sow with this solution once daily until the suckling pigs are six weeks old has proved to be a satisfactory treatment. Anemia has also been prevented by administering the iron solution as a drench once a week until the pigs are six weeks old, or twice a week until they are four weeks old. It is easier for one man to swab the udder of a sow daily than it is to drench the pigs once a week. It may be wise, especially if the solution must be applied to the udders of a number of sows at one time, to use a separate swab and container for the iron solution for each sow. This would serve as a precaution against the spread of disease, such as sore mouth in the pigs, from one litter to another, or of udder infection from one sow to another. As a rule, both the sows and the pigs will make less noise and cause less commotion in the barn when the swabbing method is used.

Either of these treatments should be started when the pigs are two or three days old. Too large doses of the iron solution will cause scours and occasionally will cause vomiting. One-third teaspoonful of the solution should be a maximum dose for pigs one week of age. This dosage may be increased until the pigs are receiving one teaspoonful when they are about three or four weeks old.

Rickets or paralysis

It is claimed by some that paralysis (or rheumatism as it is sometimes called), particularly of the hind quarters, is due to keeping the pigs indoors on concrete or wooden floors. A number of experiments have shown that this stiffness, or rickets as it is now known, is due to malnutrition,

¹⁴ Anemia in suckling pigs. By E. B. Hart, C. A. Elvehjem, H. Steenbock, G. Bohstedt, and J. M. Fargo. Wisconsin Agr. Exp. Sta. Bul. 409:1-14. 1929.

¹⁵ The production and care of nutritional anemia in suckling pigs. By T. S. Hamilton, G. E. Hunt, H. H. Mitchell, and W. E. Carroll. Journ. Agr. Res. 40:927-938. 1930.

¹⁶ Suckling pig losses and anemia. By L. P. Doyle. Purdue Univ. Agr. Exp. Sta. Cir. 188:1-8. 1932.

¹⁷ Anemia in suckling pigs. By J. P. Willman, C. M. McCay, and F. B. Morrison. Am. Soc. An. Prod. Proc. 1932:141-145. 1932.

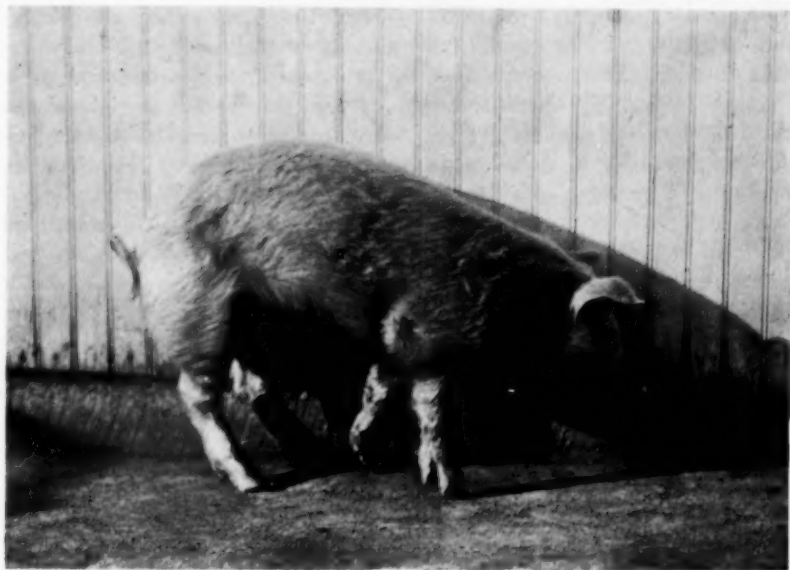


Figure 23. This pig is typical of one affected with rickets. Note the unthriftiness and the position of the legs.

the lack of the proper amount of minerals or vitamins, or perhaps both, in the ration. A further discussion of this is given under *vitamins* (page 46).

Hog cholera

Hog cholera is a serious disease of swine, which is found in many parts of the world. It is highly contagious and is caused by a virus which is present in the blood, feces, urine, and secretions of the eyes and nose of a hog affected with this disease. Hogs that are suffering from cholera usually run a high fever and their chances for recovery are small. There is no known cure.

One way to prevent the occurrence of this disease is to keep it out of the herd. Cholera spreads by the virus being carried from a dead hog or from one hog yard to another yard. Dogs feeding on the carcass of a cholera hog often spread the disease. All dead hogs should be either burned or buried deeply. Cholera may be brought into the herd by an infected breeding crate or in the material used for bedding. It may be carried by streams of water. It is wise to keep hogs away from streams flowing through farms

where cholera exists. It is dangerous to visit a neighbor's sick hogs, for the virus of cholera may be carried from his herd to one's own herd.

Another means of prevention is by immunization, or vaccination as it is sometimes called. Three methods are used in immunizing pigs. One method consists of giving the pigs an injection of serum alone, which imparts an immunity that lasts perhaps for from four to six weeks. Another method is to immunize pigs by the simultaneous method (serum and virus given), which imparts an immunity which lasts throughout the life of the pig. A third method of immunization is with the use of a vaccine prepared specifically for this purpose.

Whether pigs should or should not be immunized is not discussed in this bulletin. This decision should be made by the veterinarian who understands the conditions. Also, the method of immunization employed should be determined by the veterinarian, in consultation with the owner. The breeders or feeders of large numbers of hogs, especially garbage feeders, usually immunize their pigs regularly. It pays to treat the pigs as early in life as possible because when the pigs are young they are much easier to handle and the cost of immunization usually is less.

Worms

The round worm is one of the most common internal parasites of swine. The amount of trouble caused by this worm is cut down considerably when a system of swine sanitation, such as the one outlined on pages 20 to 22, is followed. It is much more satisfactory to prevent roundworm infestation than it is to allow the pigs to become infested and then to try to rid the pigs of worms. Very often the worms have done much damage which cannot be repaired before they have reached the stage where they may be removed from the body by medicinal treatment.

It is reported by the United States Department of Agriculture, Bureau of Animal Industry, that their work with *sodium fluoride* confirmed the efficacy and safety of this treatment.¹⁸ Commercial, tinted sodium fluoride, given as 1 per cent of the dry, ground feed for one day removed almost all of the roundworms (ascarids) from 59 head treated. In these tests, the pigs were fed dry, ground feed for two or three days before treatment with sodium fluoride, to accustom them to this feed. Growing pigs subjected to risks of heavy roundworm infestations may benefit from two treatments. The first treatment may be given when the pigs are from seven

¹⁸ Sodium fluoride removes swine ascarids safely and effectively, p. 49-50. (*In Report of the Chief of the Bureau of Animal Industry, U. S. Dept. Agr., 1946.*)

to ten weeks of age and the second treatment about four to six weeks later. The author of this bulletin suggests that swine breeders and feeders consult their local veterinarian before using this treatment the first time. Sodium fluoride is poisonous and should be handled with care.

Tetrachlorethylene has been found to be efficient as a worm expellent. Directions for the use of this drug are usually supplied with the container. Tetrachlorethylene capsules, and also the mouth spreaders and capsule forceps with which they are given, may be obtained at many drug stores. Treatment with tetrachlorethylene requires more labor than the use of sodium fluoride.

Lice

Lice are one of the most common external parasites of swine. When nothing is done to control them, they usually can be found at almost any time in a great many herds. Lice live by sucking the blood and lymph from the hog. Usually they can be found back of the ears, under the elbows of the front legs, and between the hams. It is not uncommon to find a great many of them on the bellies of suckling pigs.

It is reasonably easy to rid hogs of lice by dipping, spraying, or by greasing the pigs with crude oil or worn-out crank-case oil. Satisfactory results are obtained when the pigs are greased behind the ears, along the top line, between the hams, and under the elbows of the front legs. They should receive this treatment at least two times at intervals of about 14 to 16 days or until the lice have disappeared. It is easy to grease a number of small pigs if they are crowded in a corner and then sprinkled with oil poured from a sprinkling can. The small pigs usually crawl over each other sufficiently to oil themselves thoroughly.

Swine should not be oiled on very cold days, nor should they be oiled and then turned out into the bright sun. In large herds it may pay to build a dipping tank that can be used for the control of lice or mange.

The use of *benzene hexachloride* (lindane) applied as a spray is an easy way to eradicate lice.

Mange

Mange is a skin disease that is caused by parasites called *mites*. This disease manifests itself by the formation of scabs around the eyes and ears, which spread to the neck and shoulders and along the back and sides and in advanced cases it may cover the entire body. There are two kinds of mange. Each is caused by a different species of mange-mite. One of these mites burrows into the skin and the other into the hair follicle. Several methods may be used in treating mangy hogs, but no doubt the use of hand

applications is the most satisfactory method in small herds. A good treatment for mange is given in the following paragraph.

A treatment for lice and mange¹⁹

Benzene hexachloride (containing 5 or 6 per cent gamma isomer) will eradicate hog lice and hog mange. It may be applied with a low-pressure hand sprayer for the control of lice, but for the control of mange it is best to apply it at a pressure of 400 pounds. If power spraying equipment is not available for mange control, hand sprayers may be used but the treatment must be repeated two or more times with a week or ten days between treatments. Six pounds of benzene hexachloride (5 or 6 per cent gamma isomer or its equivalent) should be mixed with 100 gallons of water. With high-pressure applications, usually one treatment is enough. Because of its strong odor, benzene hexachloride should not be applied to swine that will be slaughtered within 50 or 60 days. *Certain materials containing greater concentrations of benzene hexachloride are available and give good results when used as directed by the manufacturer.*

Other diseases

Other diseases, such as sore mouth, bull nose, and scours, are usually the results of infection from filthy houses and quarters. These, and also other ailments of swine, may be prevented or eliminated through proper methods of sanitation, as outlined on pages 20 and 21 for the prevention of roundworm infestation. The local veterinarian should be consulted for treatment of sick pigs or hogs.

DEFINITION OF TERMS

A **boar** is a breeding male of any age.

A **sow** is a female of any age.

A **gilt** is a young sow, usually under one year of age, which has not farrowed a litter.

A **barrow** is a male which was castrated while young and before becoming sexually mature.

A **stag** is a hog which was castrated after becoming sexually mature.

A **shote** is a young barrow or gilt which weighs from 100 to 150 pounds.

¹⁹ From H. H. Schwardt, Department of Entomology, Cornell University, Ithaca, New York.

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